English
16.9.2008

SERVICE MANUAL FOR HOIST CONTROL DEVICE

R&M MATERIALS HANDLING INC.

R&M Materials Handling, Inc.
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Read the instructions supplied with the product before installation and commissioning.

Keep the instructions in a safe place for future reference.

Table of content

1 General 5
1.1 Description 5
1.2 Directives, Standards and Patents 5
1.2.1 Directives 5
1.2.2 Standards 5
1.2.3 Patent Pending 6
1.2.4 Certificate of compliance 6
2 Technical characteristics 7
2.1 Description of terminals 8
2.2 Product description sticker 10
3 Display unit 11
3.1 Push-buttons 11
3.2 LEDs 11
3.3 Display information 12
3.3.1 Tare load / actual load mode 12
3.3.2 Menu Mode 13
3.3.3 Status mode 13
3.3.4 Sum load / solo hoist load mode 13
3.4 Menus 14
3.4.1 Moving in menus 14
3.4.2 Password 14
3.4.3 Hoist selection (only multi-hoists) 14
3.5 Parameters 15
3.5.1 Read-only parameters 15
3.5.2 Adjustable parameters 15
3.6 Remote Display 16
3.6.1 General 16
4 Parameters 18
4.1 Passwords 20
5 Basic Functions 21
5.1 General 21
5.2 Overload protection 22
5.3 Hoist motor overheating supervision 23
5.3.1 Hoist motor overheating supervision instructions 25
5.4 Supply voltage phase supervision 26
5.4.1 Supply phase supervision instructions 26
5.5 RUN and fault supervision 27
5.6 Starting and stopping through slow speed (2 speed application only) 28
5.6.1 Starting and stopping through slow speed instructions 28
5.7 Sudden load increase supervision 29
5.7.1 Sudden load increase supervision instructions 29
6 Monitoring Items 30
6.1 General 30
6.2 Primary monitoring items 30
6.2.1 Starts counter 31
6.2.2 Run Time counter 31
6.2.3 Safe Working Period counter (SWP%)h 31
6.2.4 Hoist cycles counter 32
6.2.5 Run time and start counter for trolley and bridge 32
6.3 Measured values 33
7 Optional functions 34
7.1 General 34
7.2 Slack rope protection 34
7.2.1 Slack rope protection instructions 34
7.2.2 Slack rope protection connections 35
7.3 Intermediate load limits 35
7.3.1 Intermediate load limits parameters 35
7.3.2 Intermediate load limits connections 36
7.4 Run time and start counter for trolley and bridge 36
7.4.1 Run time and start counter for trolley and bridge parameters 37
7.4.2 Run time and start counter for trolley and bridge connections 37
7.5 Analogue output 37
7.5.1 Analogue output parameters 37
7.5.2 Analogue output connections 38
7.6 Free relay output 38
7.7 Hoist brake-wear supervision 39
7.7.1 Hoist brake-wear supervision instructions 39
7.8 Load tare 40
7.8.1 Load tare instructions 40
7.9 Levelling function 40
7.9.1 Levelling function instructions 40
7.9.2 Levelling Function Connections 41
8 Multi-hoisting 42
8.1 General 42

R&M Materials Handling, Inc.
4501 Gateway Boulevard
Springfield, Ohio 45502
P.: (937) 328-5100
FAX: (937) 325-5319

8.2 Multi-hoisting instructions 42
8.2.1 Multi-hoisting parameters 42
8.2.2 Cabling 43
8.2.3 Menus through CAN bus 44
8.3 CAN-bus topology 45
8.3.1 Termination resistors 45
8.3.2 Recommended topologies 46
9 Commissioning 47
9.1 Start-up 47
9.2 Load measure 47
9.2.1 Load measure type by ”Motor”, (see the parameter 4-7-1) 47
9.2.2 Load measure type by ”Sens.”, (see the parameter 4-7-1) 47
9.3 Functional checks 48
9.3.1 Multi hoisting 48
9.3.2 Multifunction inputs 48
9.3.3 Functional free relay output ROUT 49
9.3.4 Analog output AOUT 50
9.3.5 Slack rope 50
9.4 Commissioning table 51
10 Overload protection – Load sensor 52
10.1 Load sensor-system 52
10.1.1 Load sensor set-up 52
10.2 Load sensor parameters 52
10.3 Load calibration sequence with load sensor 53
10.4 Manual load calibration 54
11 Overload protection – Motor torque 55
11.1 Overload protection instructions 55
11.1.1 Motor torque calculation-system 55
11.1.2 Motor torque calculation parameters 55
11.2 Connections 57
11.3 Load calibration sequence with motor torque 58
11.4 Zero load calibration sequence with motor toque 59
11.5 Manual load calibration 59
12 Load sensor adjustment 61
12.1 KAE400 + Strain Gauge 61
12.1.1 General 61
12.1.2 Technical data 61
12.1.3 Wiring 61
12.1.4 Adjustment 62
12.1.5 Dimensions 63
12.2 ESD142 amplifier + Strain Gauge 63
12.2.1 ESD142 Description 63
12.2.2 Adjustment 64
12.2.3 Zero load adjustment 64
12.2.4 Adjustment with higher load 64
12.2.5 Connections 65
13 Faults and warnings 66
13.1 Faults 66
13.1.1 Fault codes and description 66
13.2 Warnings 67
13.2.1 General warnings 67
13.2.2 Service warnings 67
14 Troubleshooting 68
14.1 Fault descriptions 68
14.1.1 Fault Hoist OL F_OL 68
14.1.2 Fault Motor OT F_OT 70
14.1.3 Fault Int. relay F_SR 70
14.1.4 Fault RUN act. F_Run 70
14.1.5 Fault Run FB – (2) 70
14.1.6 Fault Brake F_Br 71
14.1.7 Fault Br wear F_Brw 71
14.1.8 Fault Sensor ch. F_SCh 72
14.1.9 Fault Curr.meas. F_Ain 72
14.1.10 Fault Supply vol F_SPh 73
14.1.11 Fault Phaseorder F_Sor 73
14.1.12 Fault CParameter F_CP 73
14.1.13 Fault MParameter F_MP 73
14.1.14 Fault CAN bus F_CAN 74
14.1.15 Fault Bridge OL F_BOL 74
14.1.16 Fault Bridge RS F_Brs 74
14.1.17 Fault Slack Rope – (2) 74
14.2 No Signal – (2) 74
14.3 Blank display 75
14.4 The temperature sensors (NTC-wiring) 75
14.5 Current transformers 75
14.6 There is no fault, but hoist doesn’t work 76
14.6.1 Hoisting works, but lowering is prevented 76
14.6.2 Hoisting and lowering prevented 77
15 Replacement Instructions 78
15.1 General 78
15.2 Ordering a new Monitoring unit 78
15.3 Replacing 78
15.4 Parameters and Values 78
15.5 Flow chart 81
16 Menu structure 82
16.1 Monitor 1 (Menu 1) 82
16.2 Monitor 2 (Menu 2) 83
16.3 Load calibration menu (Menu 3) 84
16.4 Start-up menu (Menu 4) 85
16.5 Service menu (Menu 5) 88
16.6 Design values menu (Menu 6) 88
16.7 GO –settings menu (Menu 7) 89
Appendix 1 - Default parameters 90
Appendix 2 - Version History 91
Appendix 3 - Current Transformer’s information 93
Appendix 3.1 Current transformer table 95

R&M Materials Handling, Inc.
4501 Gateway Boulevard
Springfield, Ohio 45502
P.: (937) 328-5100
FAX: (937) 325-5319

Appendix 4 - Motor temperature NTC charts 97
Appendix 5 - Example connections 98
Appendix 6 - External power supply for ESD 143..... 101
Appendix 7 - Replacing the condition monitoring unit..... 103

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Springfield, Ohio 45502
P.: (937) 328-5100
FAX: (937) 325-5319

1 General

1.1 Description

The hoist-monitoring unit is an electronic device designed to supervise and protect the hoist. The hoist-monitoring unit measures the use of the hoists and prevents hoisting or lowering in case a situation is detected which can cause a potential dangerous situation. The hoist-monitoring unit records the use of the hoist and calculates the remaining Safe Working Period “SWP” according to the FEM and ISO standards.

The hoist-monitoring unit is designed to fit a wide variety of hoists and motor drives. It can be used with variable speed control drives, as well as two speed drives. The hoist-monitoring unit contains tailored hardware and software, especially designed for crane use.

With the display, the unit can be programmed and calibrated, and stored values can be read. The hoist-monitoring unit can be equipped and installed with many different options and additional features such as:

- continuous load display
- tandem operation (up to five units)
- service-warning information
- hook levelling
- intermediate overload options

A service agent authorised by the manufacturer can provide detailed information and professional advice on a tailored solution for each application.

The hoist-monitoring unit is a safety device, installed by the manufacturer. Only service personnel authorised by the manufacturer are allowed to program and calibrate the unit. Faulty programmed or calibrated unit may cause malfunctions that results in dangerous situations.

Under no circumstances it is allowed to by-pass or remove the hoist-monitoring unit, as that would disable all supervision and safety features.

1.2 Directives, Standards and Patents

1.2.1 Directives

The product conforms to the relevant safety provisions of the

- EMC Directive (2004/108/EC)
- Low Voltage Directive (2006/95/EC)

1.2.2 Standards

The product complies with the following standards:

- EN 50081-1 (1992) Generic emission standard: Residential, commercial and light industry
- EN 61000-6-2 (1999) Generic immunity standard: Industrial environment
- EN 50178 (1997) Electronic equipment for use in power installations
- EN 60204-32 (1998) Safety of machinery – Electrical equipment of machines. Part 32: Requirements for hoisting machines
- EN 12077-2 (1998) Cranes safety. Requirements for health and safety. Part 2: Limiting and indicating devices

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1.2.3 Patent Pending

- US09/940,514 EP01000406,7
- US09/940,464 EP01000405,9

1.2.4 Certificate of compliance

- 1334676 (LR025623)

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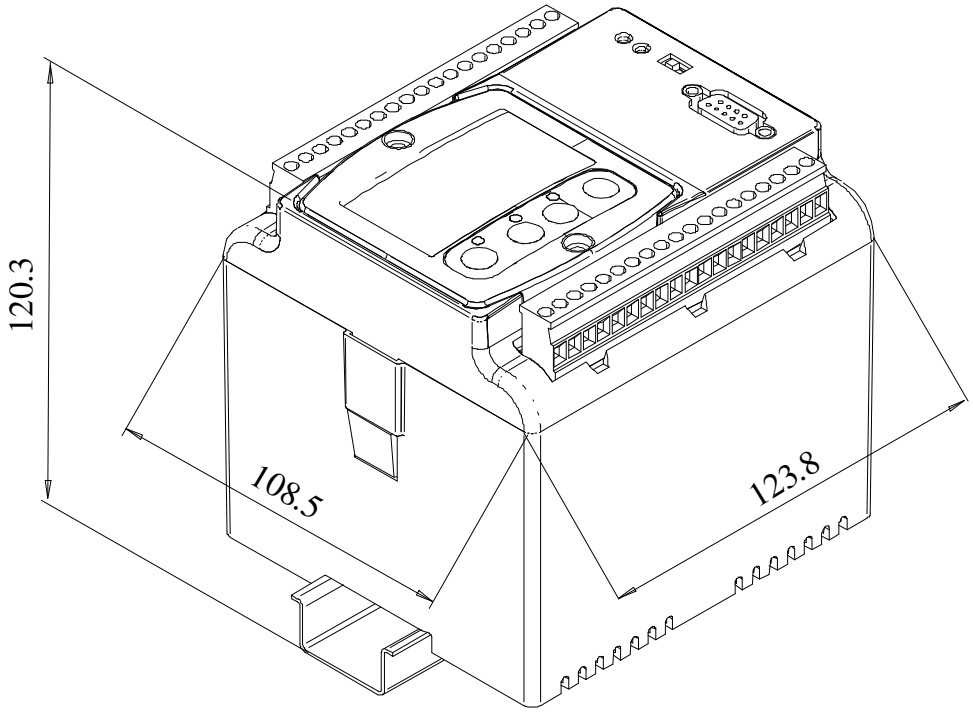
2 Technical characteristics



Signal name	Technical data
Maximum supply voltage	690 VAC +10%
Nominal supply frequency	50/60 Hz
Control voltage range	42…48 VAC +/- 10% or 115…230 VAC +/- 10%
Maximum power consumption	Imax = 4,5A peak value
Power consumption	6W …8W
Ambient temperature	-20ºC…+65ºC; 0ºF…+150ºF
Storage temperature	-40ºC…+85ºC; -40ºF…+185ºF
Humidity	0…100% RH, no condensation
Analogue output	0…10V, Rmin=1kΩ
10VDC output	10…12 VDC, Imax=50mA
Potential free relay output (Programmable)	230VAC, 3A
Current loop	12 V, I = 50…70mA
CAN	0: Ucan-H = 2.5VDC, Ucan-L = 2.5VDC 1: Ucan-H = 3.5VDC, Ucan-L = 1.5VDC (respect to CAN-GD)
Height (including 15mm assembly rail)	120.3mm; 4.73in
Length	123.8mm; 4.87in
Width	108.5mm; 4.27in
Tightening torque of connector terminal screw	0,4 Nm – 0,6 Nm

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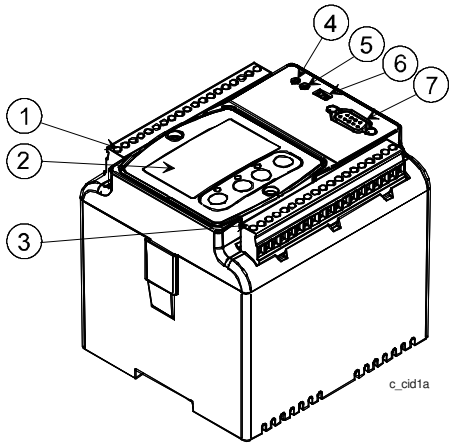
2.1 Description of terminals



1. Connector X1: Terminals 1-19 for “power signals” (high voltage)
2. Display unit with pushbuttons and three indication LEDs (optional)
3. Connector X2: Terminals 20 -38 for the measurement signals (low voltages).
4. Green LED (OK and run state indication)
5. Red LED (warning and fault indication)
6. Selection switch for display location (inside the unit or remote)
7. RS232 serial link, e.g. for PC software (optional) or PLC system

Connector X1:

Terminal	Signal	Description
1	LOUT	Provides the control voltage to lower down contactor (two step control) or lower down request. (inverter drive)
2	HOUT	Provides the control voltage to hoist up contactor (two step control) or hoist up request (inverter drive)
3	FOUT	Provides the control voltage to fast speed contactor (two step control) or fast stop control (stop limit or fault in inverter drive)
4	OL	Control voltage, line
5	ON	Control voltage, neutral
6	MFI2	Multifunction input 2 (programmable)
7	MFI1	Multifunction input 1 (programmable)
8	FIN	Fast speed request or run feedback in inverter drive
9	LIN	Lowering request
10	HIN	Hoisting request
11	ROUT	Relay output (programmable)
12	RIN	
13	-	Not used
14	-	Not used
15	L3	Input voltage measurement, phase L3
16	-	Not used
17	L2	Input voltage measurement, phase L2
18	-	Not used
19	L1	Input voltage measurement, phase L1

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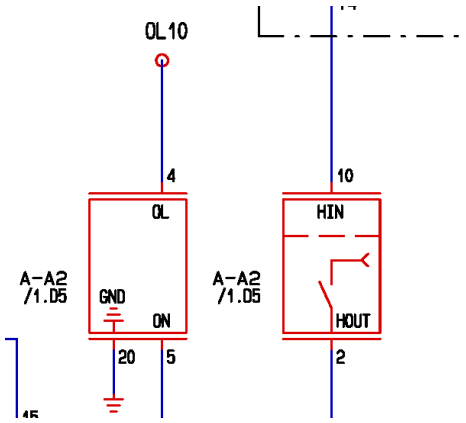
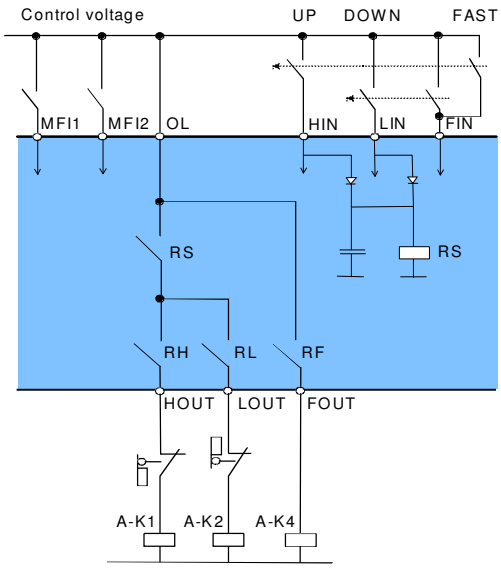
Connector X2:

Terminal	Signal	Description
20	PE	Protective earth
21	TP11	Thermistor input 1
22	TP12	
23	TP21	Thermistor input 2
24	TP22	
25	10V	Load sensor supply, 10...12 VDC
26	AIN1	Analogue input 1
27	AIN2	Analogue input 2
28	AIN3	Analogue input 3
29	IB	Current transformer common
30	0V	Load sensor supply, 0 V
31	-	Not used
32	CL-A	Current loop for display
33	CL-B	
34	AN	Analogue output
35	AN0	Analogue output, ground
36	CAN-H	CAN bus, high
37	CAN-L	CAN bus, low
38	CAN-GD	CAN bus, neutral

Input request is not directly connected to the output. Output voltage comes from Control Voltage Line (OL) (via Safety Relay and Control relay). See simplified pictures.



Connections on eldrawings



Unit's internal connections

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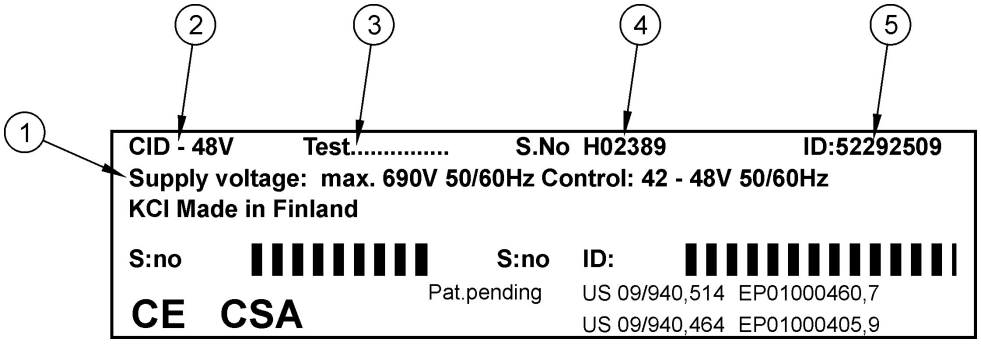
2.2 Product description sticker



1.Supply voltage / Control Voltage
2.Unit type
3.Tested (year, week, tester)
4.Serial number
5.Product specific code

Unit types

Unit type	Serial number	Product specific code	Control voltage
CID-48V	Hxxxxx	ID: 52292509	42-48 VAC
CID-115V	Txxxxx	ID: 52292510	110-230 VAC

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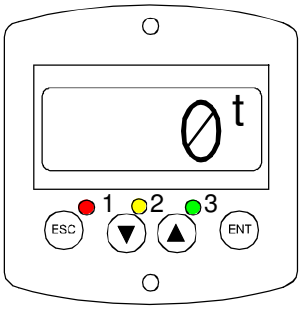
3 Display unit



1. Red LED (Fault and Warning indication)
2. Orange LED (Tare load active)
3. Green LED (OK and Run indication)

The display unit shows in the large text field the actual or tared load. Also warning and fault messages are shown in the display. Parameter values can be read and set via display unit after a correct password has been given. Load information are displayed in a single row, other information are displayed in two rows. If display is inside the hoist-monitoring unit, the red display selection switch must be on the local position (up position).

☞ Please note that the hoist-monitoring unit is designed for overload protection. The displayed load has an accuracy of approx. ±5% of the rated load and is thus not suitable to be used as a calibrated weighing scale.

3.1 Push-buttons

On the display are four pushbuttons for navigating and programming.

ESC	1. Zeroing of tare load. Press ESC button for three seconds. 2. Moving from submenu to main menu and reject parameter changes
▼	1. Toggle between actual load (orange LED off) and tare load (orange LED on) 2. Scrolling down
▲	1. Toggle between actual load (orange LED off) and tare load (orange LED on) 2. Scrolling up
ENT	1. Entering the password level 2. Selecting a menu and accept parameter changes

3.2 LEDs

There are three LEDs inside the display unit. The left red LED is for fault or warning indication. The orange or yellow LED in the centre is active when the tare load is selected. The right green LED is on when the hoist-monitoring unit is OK and blinks when the hoist is running.

Action / LED	**Red LED (Left)**	**Orange LED (Centre)**	**Green LED (Right)**
Illuminated continuously	Fault	Tare load value displayed	OK, not running
Blinking	Warning and Service	-	OK, running
Not illuminated	OK	Actual load value displayed	Fault

OK state means that the hoist control unit is working normally and no fault or error has been detected. When a driving output or the run feedback in inverter application is active, the green LED is blinking.

Warning means that a condition monitoring value exceeds the corresponding design value. Running the hoist is possible, but safe using is not guaranteed.

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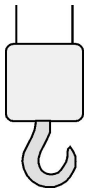
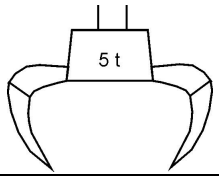
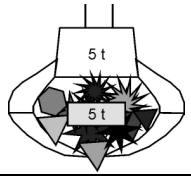
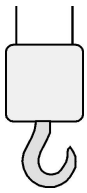
Service-state means that a limit value set for the next service has been expired. This is indicated to the crane user, but the hoist can still be run normally.

Fault-state means that a serious problem has been detected. Running the hoist is restricted.

3.3 Display information

3.3.1 Tare load / actual load mode

Tare load can be used when the crane is operated with a load-handling device, such as a grab or spreader. When no load-handling device is used, the tare load must be set to zero with empty hook. Considering a grab crane as example the table explains the differences between tare load and actual load. Press UP or DOWN button to toggle between tare and actual load.

Hoist application	Description	Display information	
		Orange LED ON TARE LOAD	**Orange LED OFF ACTUAL LOAD**
10t grab without grab 	Only empty ropes or empty hook block. No load in the crane.	Displayed value depends on last zeroing. 0.2 t or zeroing press ESC for three sec. Display shows now 0.0 t	0.2 t
10 t grab crane 	A grab is attached to the ropes. Grab weight is 5 tons. The grab is empty and not loaded.	5.0 t Press ESC button for three sec. Display shows 0.0 t	5.2 t
10 t grab crane 	The grab is loaded with 5 tons payload.	Display shows 5.0 t This is the payload of the load-handling device.	The payload + grap weight 10.2 t
10 t grab crane without grab 	Only empty ropes or empty hook block. No load in the crane.	Last zeroing was made with 5 tons attached. Display shows -4.8 t Press ESC button for three sec. Display shows 0.0 t	0.2 t

☞ When the display is in the load mode, the load can be tared (value set to zero) by pushing the ESC button about three seconds and after that display shifts into the tare load mode.

☞ Tare function is made for each hoist individually; means tare command is not transferred to other units via CAN bus.

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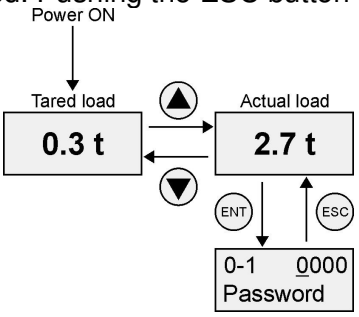
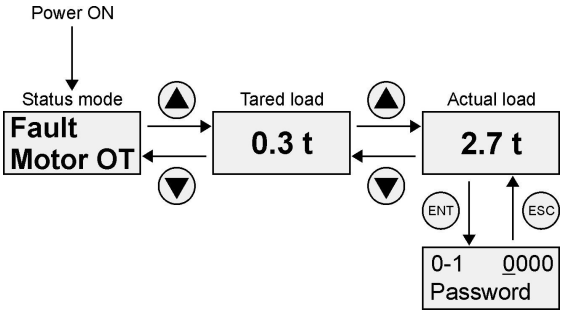
3.3.2 Menu Mode

Pushing the ENT button in the tare or actual load display mode, shifts the display into the menu mode. A password is required in order to proceed. Pushing the ESC button returns to the actual load display.



3.3.3 Status mode

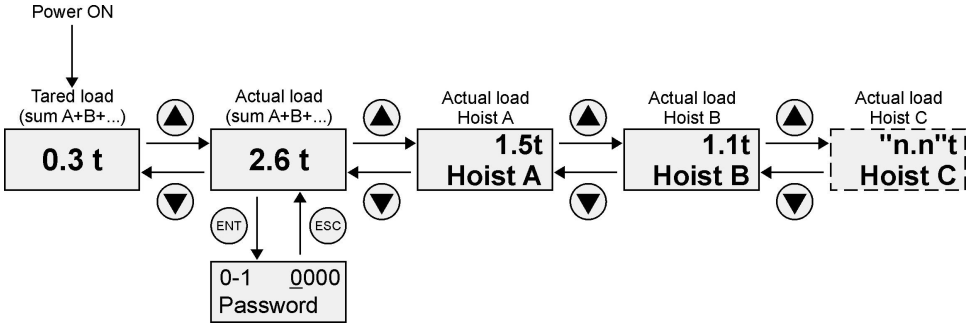
Status mode indicates all active faults, warnings and service warnings when applicable. The display shifts automatically into the status mode when a fault or warning occurs during power ON. If more than one fault or warning are active, all of them can be seen with arrow keys; active faults first, then warnings and service warnings. The active fault message remains visible until the fault disappears, or the message is removed by pushing the ENT button.



Display	Description
Fault Fault name	Status display indicating active faults status.
Warning Warning name	Status display indicating active warnings status.
Service Service name	Status display indicating active service status.

3.3.4 Sum load / solo hoist load mode

In multi-hoist applications, the display shows the summed tare load as the first display at power on. Toggling between the tared sum load, the actual sum load and the actual load of each connected hoist individually is done with the up and down buttons.



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3.4 Menus

Monitoring items and parameters are presented in menus. The menus are accessible with passwords. The right to read and/or modify parameters within a menu depends on the selected password.

3.4.1 Moving in menus

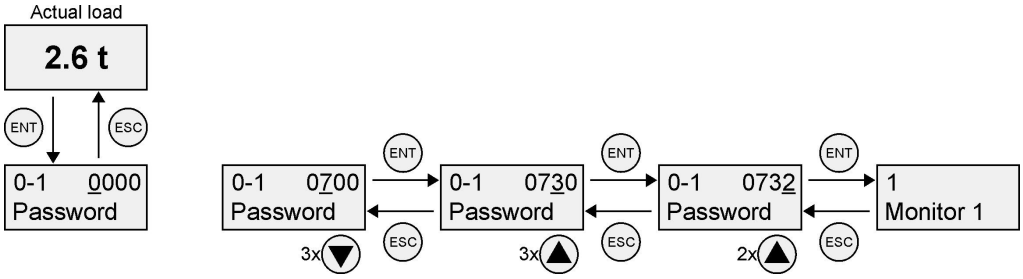
Toggling between the menus is done with the up and down arrow buttons. When the desired menu has been selected, it is entered with the ENT-button. If there are submenus in the main menu, they are selected and entered in the same way as described above. Returning to the higher menu level is done with the ESC-button.

3.4.2 Password

When the ENT key is pushed the display shifts to the password request menu. With the ESC key or when an incorrect password is given, the display shifts back to the load display.

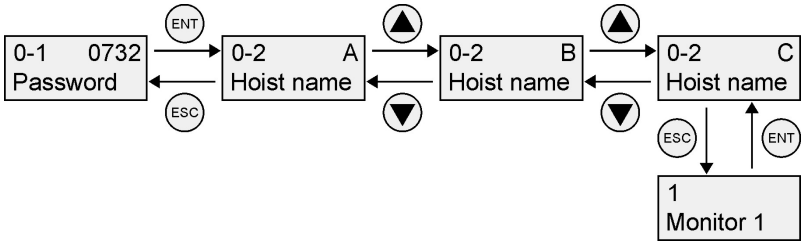
The first display of the password select menu shows four “zeros”, with the leftmost underlined. Pushing the up and down button will change the digit. The desired digit is selected with the ENT button, after which the next digit will be underlined. Repeat this procedure until the correct password is given. The display will now show the first menu **“1 Monitor 1”**.

(Example: Level 2 password “0732”)



3.4.3 Hoist selection (only multi-hoists)

In multi-hoist applications, where more then one unit are connected with the CAN-bus, the display will ask to select the desired unit (A, B, C, D or E) before the display shows the first menu. This way, each unit can be accessed via another unit. For example, all parameters and values of unit C can be displayed and modified via unit A.



When reading data from the display in multi hoist application, verify that you are reading the data from the correct device. The selected hoist is shown in the 0-2 display.

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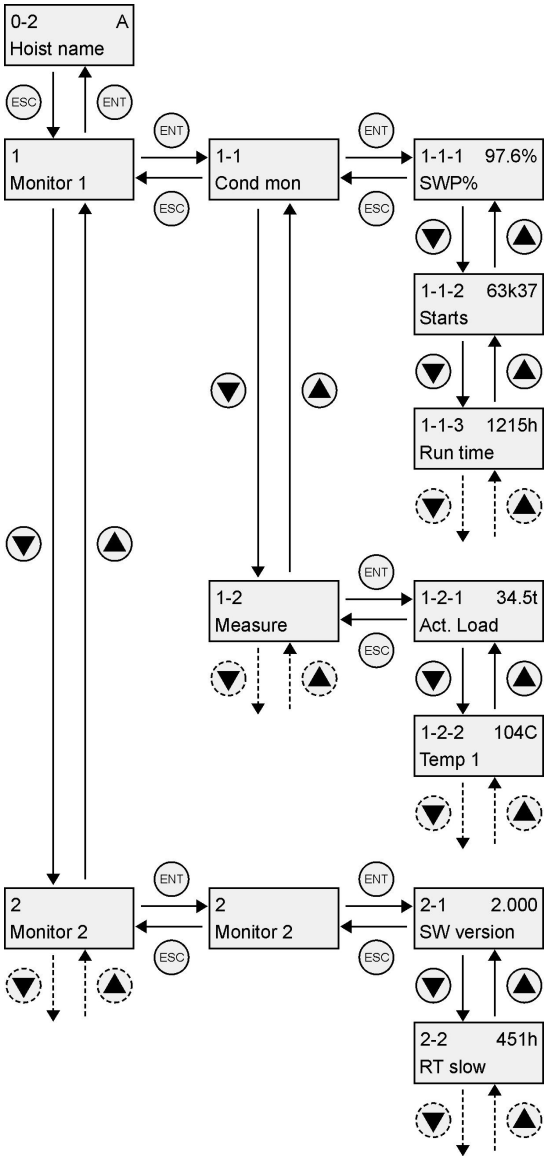
3.5 Parameters

3.5.1 Read-only parameters

Menu 1 (Monitor 1) and menu 2 (Monitor 2) contain read-only parameters. These menus will show the calculated and measured values of the solo hoist, connected to the selected unit.



3.5.2 Adjustable parameters

There are two sorts of adjustable parameters:

- Free adjustable (within the given limits)
- Choice from option list

When a parameter has to be adjusted, first select the desired parameter. Pushing the ENT button opens the parameter and the value can be adjusted. The free adjustable parameters will ask to adjust the digits one at the time, whereas other parameters will give the choice between a number of options.

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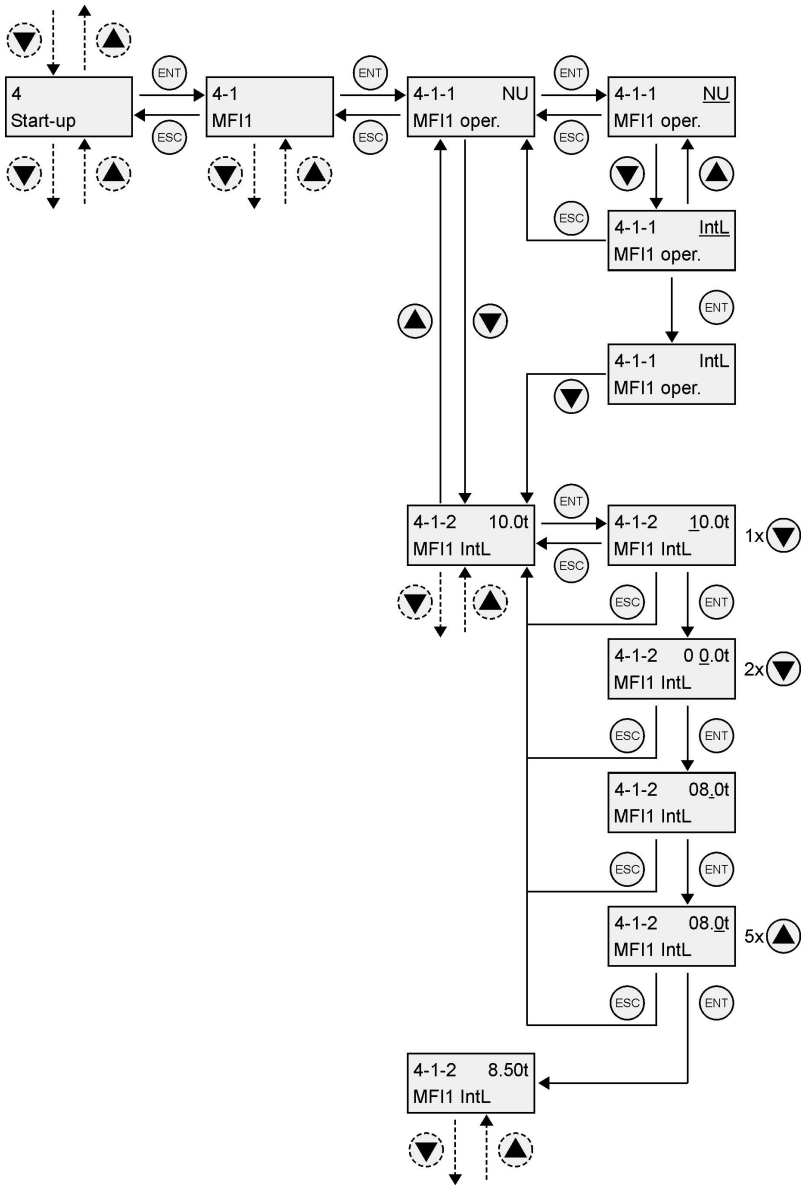
Example: selecting the MFI1 input to intermediate load function, with a load of 8.5 Tons.



3.6 Remote Display

3.6.1 General

The display can be also located at a remote location, for example in the push button station, in the cubicle-door or in a crane driver cabin. In this way the crane operator can read load information directly from the display. All features as well as the parameter structure are the same as when the display would be located at the unit. The display in the remote location is a very effective tool for applications where the crane operator needs to have a load indication when handling loads.

☞ Please note that the hoist-monitoring unit is designed for overload protection. The displayed load has an accuracy of approx. ±5% of the rated load and is thus not suitable to be used as a calibrated weighing scale.

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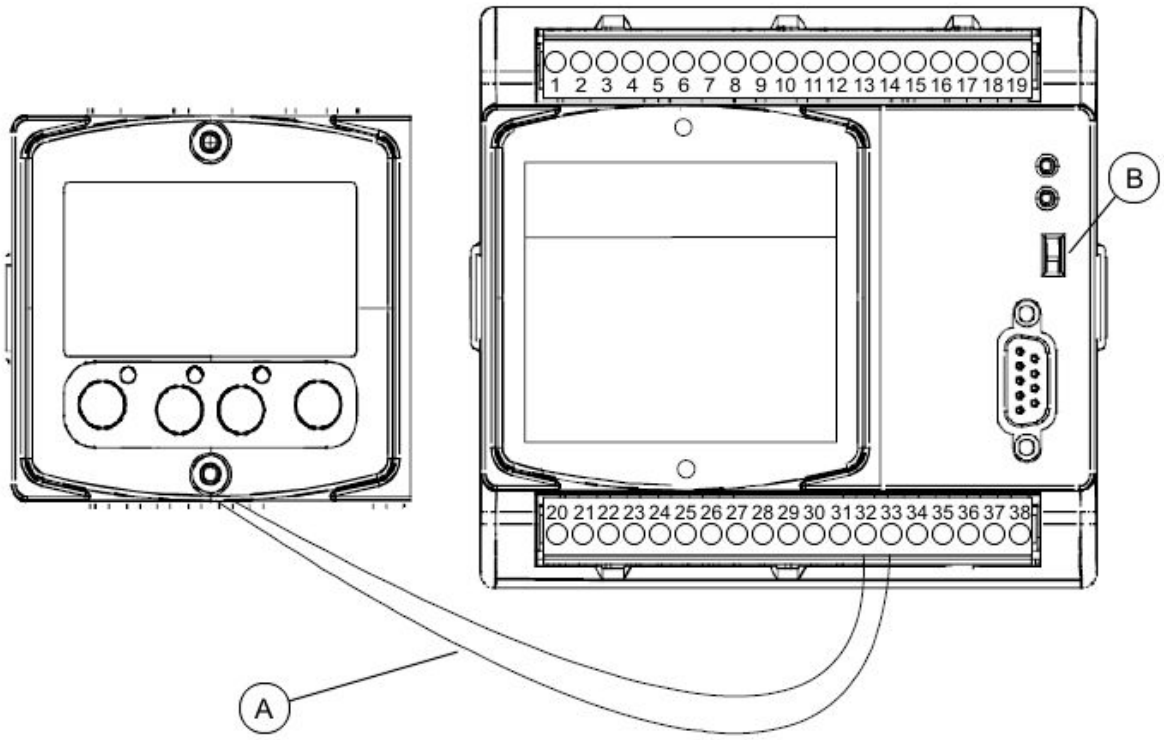
Connections and Display Selection Switch

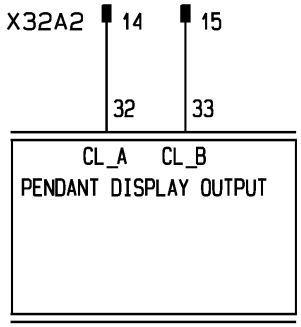


A. Current loop to remote display
B. Display selection switch in down position for remote selection

If the display is in a remote location, the display is connected via a current loop with the hoist-monitoring unit. The current loop is between terminals 32 (CL-A) and 33 (CL-B). Because a current loop is not sensitive for electrical disturbances, it is not needed to use shielded cables for the display connection.

With the red display selection switch on top of the hoist-monitoring unit it is possible to switch between the display locations. The display selection switch must be in the down position to select the remote location active.

Remote display and display in the unit cannot work simultaneously.



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4 Parameters

1	**Monitor 1**	**Read only menu for condition monitoring values and measured values.**
1-1	**Cond mon**	**Condition monitoring menu**
1-1-1	SWP%	Remaining Safe Working Period of the hoist in percentage, starting from 100%.
1-1-2	Starts	Total number of starts
1-1-3	Run time	Total running time
1-1-4	Cycles	Total number of hoisting cycles.
1-1-5	Mean load	Average of the handled load
1-1-6	Br SWP%	Remaining Safe Working Period of the brake in percentage.
1-1-7	MFI1 RT	Total hours of running time, when MFI1 input is closed.
1-1-8	MFI1 ST	Total amount of starts, when MFI1 input is closed.
1-1-9	MFI2 RT	Total hours of running time, when MFI2 input is closed.
1-1-10	MFI2 ST	Total amount of starts, when MFI2 input is closed.
1-2	**Measure**	**Measurement menu**
1-2-1	Act. Load	The measured actual load value.
1-2-2	Temp 1	Temperature measured at thermistor input 1.
1-2-3	Temp 2	Temperature measured at thermistor input 2.
1-2-4	Supply L1	Line voltage of phase L1.
1-2-5	Supply L2	Line voltage of phase L2.
1-2-6	Supply L3	Line voltage of phase L3.
1-2-7	Motor I1	Motor current of phase L1.
1-2-8	Motor I2	Motor current of phase L2.
1-2-9	Motor I3	Motor current of phase L3.
1-2-10	Ain1 value	Measured voltage at analogue input AIN1.
1-2-11	Ain2 value	Measured voltage at analogue input AIN2.
1-2-12	Ain3 value	Measured voltage at analogue input AIN3.
1-2-13	Int. temp	Internal temperature of the unit.
1-2-14	Input	Indicates the status of the inputs: HIN, LIN, FIN, MFI1 & MFI2.
1-2-15	Output	Indicates the status of the outputs: HOUT, LOUT, FOUT, RS & ROUT.
1-2-16	Supply f	Supply voltage frequency (50 or 60Hz)
1-3	**Min/Max**	**Minimum / maximum value menu**
1-3-1	Min supply	Minimum measured value of the supply line voltage RMS.
1-3-2	Max supply	Maximum measured value of the supply line voltage RMS.
1-3-3	Min Int. T	Minimum measured value of the internal temperature of the unit.
1-3-4	Max Int. T	Maximum measured value of the internal temperature of the unit.
2	**Monitor 2**	**Read only menu for advanced condition monitoring values and measured values. Accessible password level 3**
2-1	SW version	Software version of the unit
2-2	RT slow	Total run-time in slow speed
2-3	RT fast	Total run-time in fast speed
2-4	No. OT	Total number of hoist motor overtemperature incidents.
2-5	No. OL	Total number of overload incidents
2-6	E-stops	Total number of emergency stops incidents
2-7	ST up	Total number of starts in up direction
2-8	ST down	Total number of starts in down direction
2-9	ST fast	Total number of starts to fast speed (counts in two speed control only)
2-10	Max ED	Maximum value of the calculated ED percentage
2-11	Over ED	Counts the minutes when ED value has exceed the nominal ED value
2-12	SWPRT%	SWP% value calculated with hoist running time
2-13	SRT3	Load sum with hoist running time, third power
2-14	SRT8	Load sum with hoist running time, eight power
2-15	SWPHC%	SWP% value calculated with hoist cycles
2-16	SL1	Load sum with hoist cycles, the first power (mean load)
2-17	SL3	Load sum with hoist cycles, the third
2-18	SL8	Load sum with hoist cycles, the eight power
2-19	Power on	The total power on time of the unit
2-20	Temp Index	Power on time of the unit, weighted with the unit's temperature
2-21	Max load	Maximum measured value of the load
3	**Load setup**	**Load calibration menu. Accessible password level 2**
3-1	**Cal. Motor**	**Load calibration when the motor torque based load measurement is selecte. See chapter "Load calibration sequence with motor torque".**
3-2	**MC values**	**Load calibration values for the motor torque method**
3-2-1	Load 1	The higher test load's value
3-2-2	Mhs1	Motor torque for hoisting in slow speed, with load.
3-2-3	Mhf1	Motor torque for hoisting in fast speed, with load 1.
3-2-4	Mls1	Motor torque for lowering in slow speed, with load 1.
3-2-5	Mlf1	Motor torque for lowering in fast speed, with load 1,
3-2-6	Load 2	The lower test load's value.
3-2-7	Mhs2	Motor torque for hoisting in slow speed, with load 2.
3-2-8	Mhf2	Motor torque for hoisting in fast speed, with load 2.
3-2-9	Mls2	Motor torque for lowering in slow speed, with load 2.
3-2-10	Mlf2	Motor torque for lowering in fast speed, with load 2.
3-3	**Cal. Sens**	**Load calibration when the sensor based load measurement is selected. See chapter "Load calibration sequence with the load sensor".**
3-4	**SC values**	**Load calibration values for the load sensor method**
3-4-1	Load 1	The higher test load value.
3-4-2	Input 1	The load measurement voltage in the analogue input Ain1 corresponding to the higher test load
3-4-3	Load 2	The lower test load value
3-4-4	Input 2	The load measurement voltage in the analogue input Ain1 corresponding to the lower load
3-5	**OL protect**	**Set to "OFF" to temporarily by-pass of the overload protection**
4	**Start-up**	**Start- menu. Accessible password level 4**
4-1	**MFI1**	**Multi-Functional Input 1 parameters**
4-1-1	MFI1 oper.	Selects the function of MFI1:
4-1-2	MFI1 IntL	Intermediate load limit value
4-1-3	MFI1 2OLL	The second load
4-1-4	MFI1 CintL	Bridge intermediate load limit value.
4-2	**MFI2**	**Multi-Functional Input 2 parameters**
4-2-1	**MFI2 oper.**	**Selects the function of MFI2:**
4-2-2	MFI2 IntL	The (second) intermediate load limit value
4-2-3	1+2 IntL	The third intermediate load limit value
4-2-4	MFI2 2OLL	The second load limit
4-2-5	MFI2 CintL	The (second) bridge intermediate load limit value
4-2-6	1+2 CintL	The third bridge intermediate load limit value

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4-3	**ROUT**	**Relay output parameters**
4-3-1	ROUT oper.	Selects the function of the relay output
4-3-2	ROUT logic	The operation logic of the relay:
4-3-3	ROUT LoadX	The load limit to switch the relay is entered here
4-3-4	TempX meas	The temperature measurement operation
4-3-5	TempX lim	The temperature limit
4-4	**T1**	**Temperature measurement channel 1 parameters**
4-4-1	T1 operat.	Selects the function channel 1.
4-5	**T2**	**Temperature measurement channel 2 parameters**
4-5-1	T2 operat.	Selects the function channel 1.
4-6	**AOUT**	**Analogue output parameters**
4-6-1	AOUT oper.	Selects the function of the analogue output
4-6-2	Zero load	Sets the voltage level with zero-load. Range 0…10V
4-6-3	Nom. Load	Sets the voltage level with rated load. Range 0…10V
4-7	**Load param**	**Load calculation parameters**
4-7-1	Load meas.	Selects the load calculation method:
4-7-2	Load rate%	Load increase rate for controlling the hoisting in two step control.
4-7-3	R0_F	Resistance of fast speed windings at temperature T0
4-7-4	R0_S	Resistance of slow speed windings at temperature T0
4-7-5	T0	Resistance measuring temperature T0
4-7-6	Temp_slow	Temperature measurement channel for the motor slow speed windings.
4-7-7	Temp_fast	Temperature measurement channel for the motor fast speed windings.
4-7-8	C2F	Coefficient 2 for fast speed
4-7-9	C2S	Coefficient 2 for slow speed
4-7-10	C1F	Coefficient 1 for fast speed
4-7-11	C1S	Coefficient 1 for slow speed
4-7-12	ki	Reduction factor for current transformer [A/V]
4-7-13	Acc-t slow	Acceleration time from stop to slow speed.
4-7-14	Acc-t fast	Acceleration time from slow speed to fast speed.
4-8	**Hoist ctrl**	**The selection for the hoist control method**
4-9	**Slack rope**	**Slack rope function parameters**
4-9-1	SR select	Selects the slack rope function
4-9-2	Load limit	The slack rope limit
4-10	Single sup	
4-10-1	OT run ?	Selects the action when the motor temperature exceeds the limit or when “Fault, Br wear” occurs
4-10-2	OT limit	When NTC type sensor is applied the limit value for the hoist motor overtemperature
4-10-3	Supply sup	Selects the supply voltage supervision.
4-11	Comm hoist	The settings for common hoisting (multi-hoist applications)
4-11-1	Hoist cnt	The number of units connected with CAN bus. Range: 1…5
4-11-2	Run sup.	Common hoisting supervision
4-11-3	B OL	Bridge overload protection
4-11-4	B nom load	Rated load of the bridge
5	**Service**	**Start- menu. Accessible password level 5**
5-1	**S limits**	**The limit values to indicate the need for service.**
5-1-1	S Run time	Run time service limit
5-1-2	S starts	Service limit for the number of starts
5-1-3	S SWP%	Service limit for SWP%
5-1-4	S Br SWP%	Service limit for the hoist brake service life
5-2	**Fault log**	**The logger for the latest fault situations, the number “n” indicates the number of faults in the logger**
5-2-1	F_”XXX”	The latest fault.
5-2-2	F_”XXX”	The second latest fault.
5-2-“n”	F_”XXX”	The “n” latest fault (highest number is 30).

5-3	**Reset log**	**Resets the fault log by pushing the ENT button..**
5-3	Reset log ?	The reset action must be confirmed by pushing the ENT button once more
6	**Design**	**Design values menu. Accessible password level 6**
6-1	Hoist name	Identifying letter of the hoist-monitoring unit, A, B, C, D or E.
6-2	Unit No	The serial number of the hoist.
6-3	Class	Mechanical class for the hoist according to the FEM / ISO duty classes.
6-4	Nom. Load	Rated load of the single hoist connected to the unit
6-5	Nominal ED	Rated ED value of the hoist
6-6	Sp ratio	Speed ratio.
6-7	Max ST	Maximum allowed number of starts
6-8	Max E-stop	Maximum allowed number of interrupted hoists (emergency stops)
6-9	Max RT	Maximum allowed run-time in hours
6-10	D SRT3	Designed running hours, power three.
6-11	D SRT8	Designed running hours, power eight.
6-12	D SL3	Design constraint for hoisting cycles, power three
6-13	D SL8	Design constraint for hoisting cycles, power eight
6-14	MaxST MFI1	Max number of MFI1 starts.
6-15	MaxRT MFI1	Max running time for MFI1.
6-16	MaxST MFI2	Max number of MFI2 starts.
6-17	MaxRT MFI2	Max running time for MFI2.
6-18	Max Br	Max number of braking actions.
6-19	Max Control	Max number of Control (starts)
6-20	Password	Set password level 1 (4digits).
7	**GO-setup**	**GO-settings menu. Accessible password level 7**
7-1	Cycles	Number of hoisting cycles
7-2	MFI1 RT	MFI1 running time
7-3	MFI1 ST	MFI1 starts
7-4	MFI2 RT	MFI2 running time
7-5	MFI2 ST	MFI2 starts
7-6	RT slow	Run-time in slow speed
7-7	RT fast	Run-time in fast speed
7-8	No. OT	Number of hoist motor overtemperature incidents.
7-9	No. OL	Number of hoist overload incidents
7-10	E-stops	Number of emergency stops
7-11	ST up	Number of starts in up direction
7-12	ST down	Number of starts in down direction
7-13	ST fast	Number of starts to fast speed (two step control only)
7-14	Max ED	Maximum ED value
7-15	Over ED	Number of cases where ED value has exceeded the rated ED value
7-16	SRT3	Load sum with hoist running time, third power
7-17	SRT8	Load sum with hoist running time, eight power
7-18	SL1	Load sum with hoist cycles, the first power (mean load)
7-19	SL3	Load sum with hoist cycles, the third power
7-20	SL8	Load sum with hoist cycles, the eight power
7-21	Power on	The total power on time for hoist control unit
7-22	Temp Index	The power on time weighted with the hoist control unit temperature
7-23	Max load	The maximum value of the measured load
7-24	Br Count	The brake wear counter.

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4.1 Passwords

The table below indicates the access to the menus with different password levels.

The display asks for the password when the ENT button is pushed in the main load display mode. If the given password does not match to any of the levels, the display returns to the main load display mode. If the given password matches to one of the levels, the user has access to the corresponding menus according to the table below.

Main menus	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
1 Monitor 1	X		X	X	X	X	X
2 Monitor 2			X	X	X	X	X
3 Load Setup		X		X	X	X	X
4 Start-up				X	X	X	X
5 Service					X	X	X
6 Design						X	X
7 GO-setup							X

Passwords for different levels		
Level	Password	Note
Level 1	Parameter	Given with the parameter, 6–20 Password
Level 2	0732	Fixed value, can only calibrate the load measurement
Level 3	5201	Fixed value, used to read the monitoring values
Level 4	8124	Fixed value, all menus up to input/output settings and calibration
Level 5	5029	Fixed value, all menus up to service menu
Level 6	9822	Fixed value, all menus up to design limit values
Level 7	2180	Fixed value, access to all parameters

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5 Basic Functions

5.1 General

The basic functions assure the safe functioning of the hoist. The hoist-monitoring unit constantly performs a number of checks to determine if all conditions are safe in order to proceed the motion. In case the hoist-monitoring unit detects a potentially unsafe situation, the motion will be stopped. Depending on the kind of fault, both hoisting and lowering is prevented or in other cases driving in the opposite direction is allowed.

In addition to the basic functions, a wide scale of optional functions can be installed. Refer to the section “Optional functions” or contact a manufacturer’s representative for further details.

The basic functions of the hoist-monitoring unit are:
- Overload protection
- Hoist motor overtemperature supervision
- Supply phase supervision
- Run and fault supervision
- Starting and stopping through slow speed
- Sudden load increase supervision

The basic functions are factory set according to specific hoist and customer’s demand.

☞ It is possible that few basic functions can’t be used in every hoist. (e.g. Insulated network, inverter drive)

The additional optional functions of the hoist-monitoring unit are:
- Lifetime counters
- Remote display
- Multicare
- Multi function input Options
- Potentional Free Relay Options
- Analog Output

When during run one of the supervised safety features value exceeds the limit, the unit will stop the motion. Re-starting is only possible after the reason for the fault is terminated. Note that some faults are direction dependent and running in the opposite direction will terminate the fault. Refer to the sections that describe the supervisions for details.

The hoist-monitoring unit is equipped with two LEDs that provide operational information as follows:

Action / LED	**Green LED**	**Red LED**
Illuminated continuously	OK, not running	Fault
Blinking	OK, running	Warning
Not illuminated	Fault	OK

OK state means that the hoist control unit is working normally and no fault or error has been detected. Running the hoist is possible.

Warning means that a condition-monitoring value has exceeded the design value. Running the hoist is possible, but safe operation can not be guaranteed.

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Fault means that one (or more) of the supervised safety features values exceeds the limit. Running the hoist is restricted.

☞ For Run or Fault supervision, it is possible to connect an external indication device like a horn or lamp to the relay output. Relay output must be programmed to the desired function “OK” or “Ready”

5.2 Overload protection

The overload protection can be done in two ways, either with motor torque calculation or by using a load sensor. Regardless which system is used, the hoist-monitoring unit will prevent the hoisting motion when the measured load exceeds 110% of the rated load for a period of time. A filtering delay is built in to assure trouble-free lifting of a rated load. The overload protection is reset when the measured load decreases to 80% of the rated load.

☞ The overload protection reacts faster than the display updates the measured values. Therefore it may happen that the movement is stopped although the display indicates a load less than 110% of the rated load.

Overload level	Filtering time	Run-down time
140%	60 ms	~100 ms
125%	200 ms	~250 ms
110%	1000 ms	~1050 ms

The motor torque calculation system uses the motor voltage, current and temperature to calculate the motor torque and converts this into load information. This system cannot be used in combination with frequency converters, and can only measure the load when the motor is running. In addition to the overload protection, the hoist-monitoring unit also supervises the brake. When the calculated load value descends under -50% of the rated load during lowering, it indicates that the brake did not open. Lowering the hook is prevented, but lifting is still allowed.

Motors driven by a frequency converter are always equipped with a load sensor for load measurement.

Systems using a strain gauge type of sensor are also equipped with a load sensor amplifier to amplify the signal coming from the sensor. In case a Hall-type of sensor is used, the load sensor amplifier is not needed.

Param.	Name	Value	Description	
4-7	**Load param**		**Load calculation parameters**	
4-7-1	Load meas.		Selects the load calculation method:	
			NU	Not used, the display show all time to 0,0t
			Motor	Motor torque calculation. Refer to chapter **“Overload protection – Motor torque”** of this manual
			Sens.	Load sensor measurement . Refer to chapter **“Overload protection – Load sensor”** of this manual

☞ Load measurement tolerance is ±10% of nominal load by use motor torque calculation system and load measurement tolerance is ±5% of nominal load by use load sensor.

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5.3 Hoist motor overheating supervision

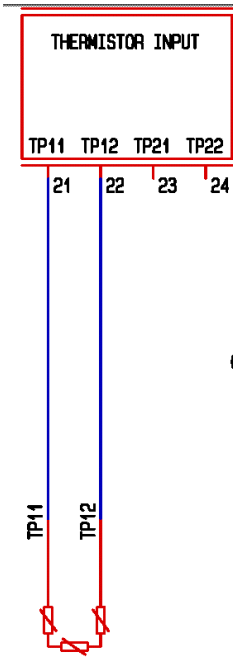
To prevent the hoisting motor from burning up, the hoist-monitoring unit will constantly measure the internal temperature of the motor. The motor is therefore equipped with temperature sensors; PTC-thermistors, NTC-thermistors or Bi-metal switches (Klixons). The hoist-monitoring unit can be programmed to either prevent both hoisting and lowering (default), or only the hoisting motion.

PTC-thermistors are commonly used in most of the motors in the past. PTC-thermistors will rapidly increase their resistance when the measured temperature exceeds the limit. The maximum allowed temperature depends on the motor and is determined by the used thermistors. The hoist-monitoring unit will detect over temperature when the resistance of the PTC exceeds 4.0kOhm.

Bi-metal switches are mounted on the motor stator windings. Bi-metal switches operate as thermal-switches and will open up the contact when the measured temperature exceeds the limit. The maximum allowed temperature depends on the motor and is determined by the used Bi-metal switches. The hoist-monitoring unit will detect overtemperature when the resistance exceeds 4.0kOhm (thus open contact).

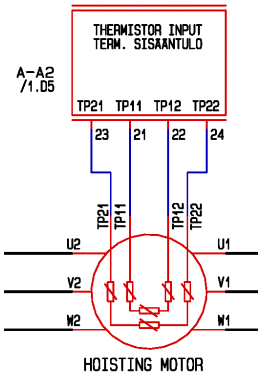
In practice, PTC-thermistors and Bi-metal switches operate in the same way. The hoist-monitoring unit stops the motion when the resistance of the temperature-measuring device exceeds 4.0kOhm.

PTC-thermistor connections



NTC-thermistors are used when motor torque calculation is the load measurement method. NTC-thermistors will decrease their resistance in an almost linear relation to temperature increase. The actual motor temperature is accurately measured with NTC-thermistors and the hoist-monitoring unit will stop the motion in case the resistance of the temperature-measuring device drops below the preset value.

NTC-thermistors connections



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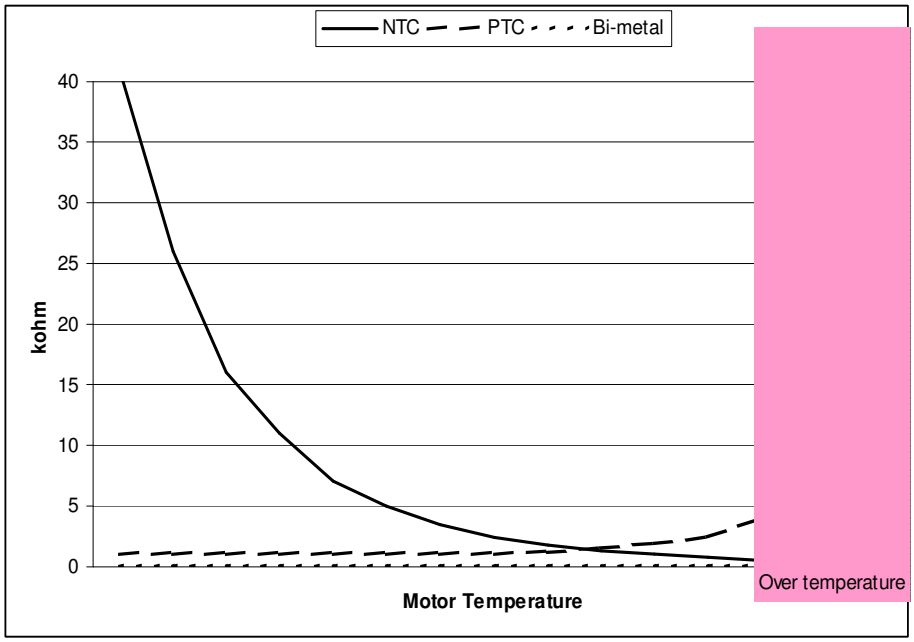
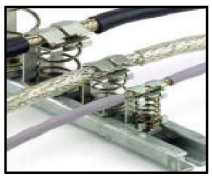
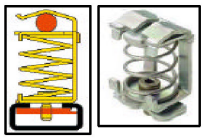
Thermistors operating curve



☞ NTC and PTC: The temperature sensor's cable must be shielded if the cable between the unit and the temperature sensors is longer than 10m. The cable shield is connected to the ground of the hoist. It is recommended to use 360 degrees shield clamps to carry out the grounding!

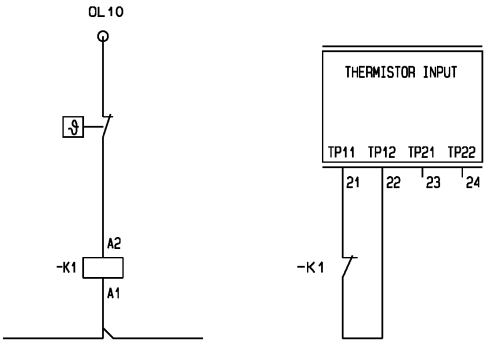




☞ Bi-metal: It is recommended to use a supplementary relay between the unit and the thermistor. In that case there is no need for a shielded cable and possible disturbance is limited to the minimum.

☞ In case third party motors are used, please consult with the manufacturer of the motor for thermistor details.

Motors without thermistors must be protected against overheating by other means, e.g. a motor protection switch.



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5.3.1 Hoist motor overheating supervision instructions

Param.	Name	Description		
4-4	**T1**	**Temperature measurement channel 1 parameters**		
4-4-1	T1 operat.	Selects the function of temperature measurement channel 1:		
		NU	Not used	Motor without thermistors or only one sensor that is connected to the temperature input 2.
		PTC	Motor thermistor or Bimetal thermal switch	Two speed motors typically only have one set of thermistors, for both low speed and high speed windings.
		Bwear	Brake wear sensor	See section Hoist Brake- Wear supervision
		A NTC	Type A NTC sensor	Determines the type of thermistors in the low speed windings, connected to the temperature input 1
		B NTC	**Type B NTC sensor**	
		C NTC	Type C NTC sensor	Manufacturer's hoisting motors used in motor-torque calculation overload systems are as a standard equipped with type B NTC thermistors

Param.	Name	Description		
4-5	**T2**	**Temperature measurement channel 2 parameters**		
4-5-1	T2 operat.	Selects the function of temperature measurement channel 2:		
		NU	Not used	Motor without thermistors or only one sensor that is connected to the temperature input 1.
		PTC	Motor thermistor or Bimetal thermal switch	Two speed motors typically only have one set of thermistors, for both low speed and high speed windings.
		Bwear	Brake wear sensor	See section Hoist Brake- Wear supervision
		A NTC	Type A NTC sensor	Determines the type of thermistors in the low speed windings, connected to the temperature input 1
		B NTC	**Type B NTC sensor**	
		C NTC	Type C NTC sensor	Manufacturer's hoisting motors used in motor-torque calculation overload systems are as a standard equipped with type B NTC thermistors

Param.	Value	Description	Note
4-10 Single sup			Accessible with password 4: 8124
4-10-1 OT run ?	No / Down	Hoisting and lowering is prevented when the overtemperature supervision trips.	If, for safety reasons, local legislation or customer demands, lowering the load is required when the temperature supervision has tripped, set this parameter to: ***"Down"***
4-10-2 OT limit	150C	Sets the tripping level of the overtemperature supervision in degrees Celsius, steps of one degree. Only with NTC-thermistor.	Consult with the motor data sheets for the maximum allowed temperature for the motor. Default for manufacturer's squirrel cage motors: 150°C

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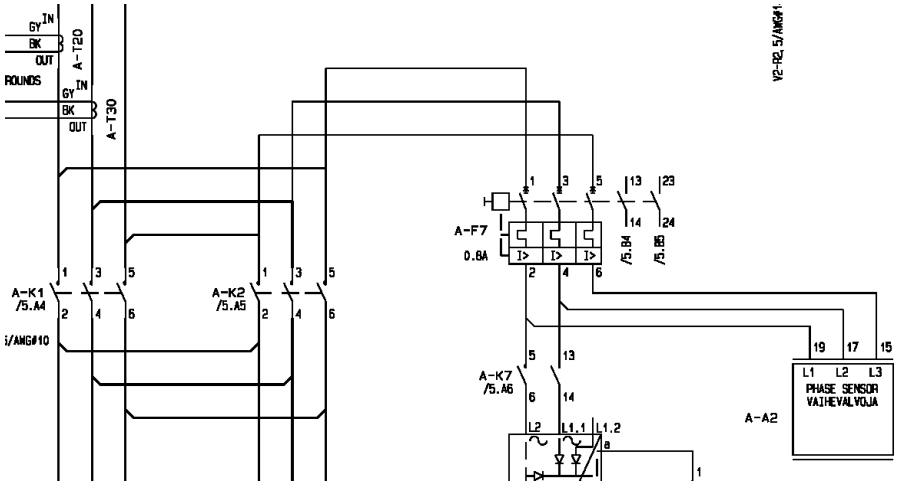
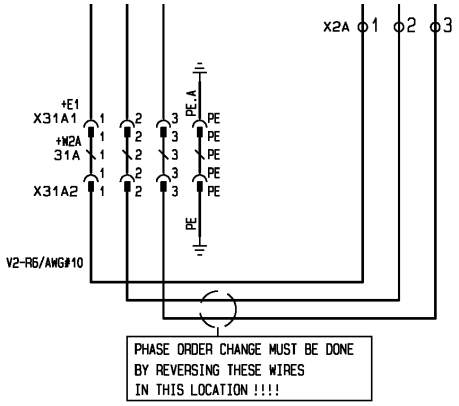
5.4 Supply voltage phase supervision

The supply voltage phase supervision consists of two functions:
- Missing supply phase detection
- Incorrect supply phase order

The three supply voltage phases are wired to the hoist-monitoring unit. Each time the unit is powered up, the phase order is checked. The unit will continuously measure the existing of all three phases.



☞ In case wrong direction of hoisting occurs (reversed phase condition), note that the two input power wires are reversed at terminal X2A!



5.4.1 Supply phase supervision instructions

Supply phase supervision parameters

Param.	Value	Description	Note
4-10 Single sup			Accessible with password 4: 8124
4-10-3	Yes	Switches the supply phase supervision on.	When the hoist monitoring-unit is connected in insulated or high impedance grounded network, or when the supply mains are not connected (i.e. inverter use), the setting must be ***"No"***.

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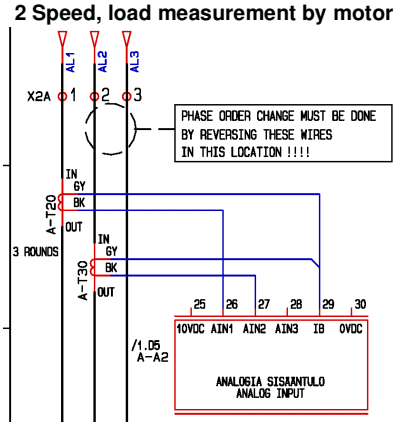
5.5 RUN and fault supervision

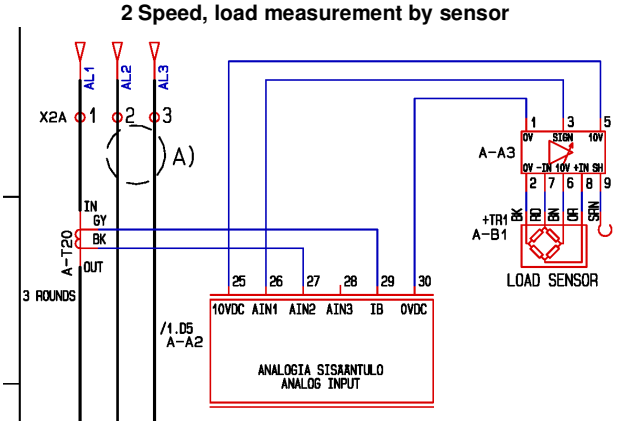
The hoisting and lowering request from the control station will come as an input to the hoist-monitoring unit. Before the hoist can start the requested motion, the hoist-monitoring unit checks if it is safe to proceed. If no limitations are detected, the hoist-monitoring unit will activate the requested output and movement will start. The unit monitors a feedback signal. When the feedback signal drops during running, the motion will stop immediately. During the starting sequence, the feedback signal must be on within 200ms in contactor control, and within 800ms in inverter control.

2 Speed Hoisting: Unit monitors a feedback signal from a current transformer to analog input 2. The current transformer measures the input current to the motor in 2 speed hoisting. During the starting sequence, the feedback signal must be on within 200ms in contactor control. When the feedback signal drops during running, the motion will stop immediately.

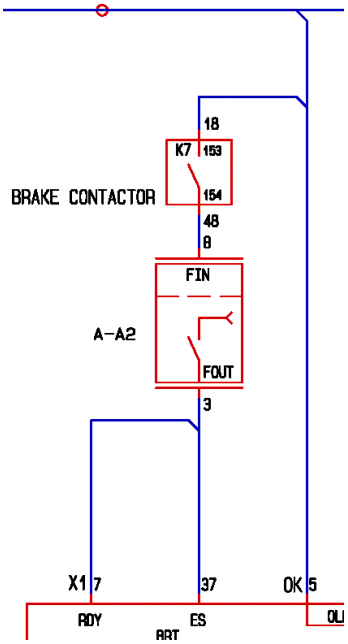
2 Speed, load measurement by motor



2 Speed, load measurement by sensor



When the unit supervises a hoist inverter application a brake contact from AK7 is connected to the FIN input, terminal 8, to be a brake open feedback signal. If the brake contactor does not energize during start or de-energizes during hoisting (initiated by a fault or due to brake failure) the unit will disconnect control voltage from the FOUT signal output, terminal 3, feeding the ES and RDY inputs of the inverter. During the starting sequence, in inverter control, the feedback signal at FIN must be on within 800ms.



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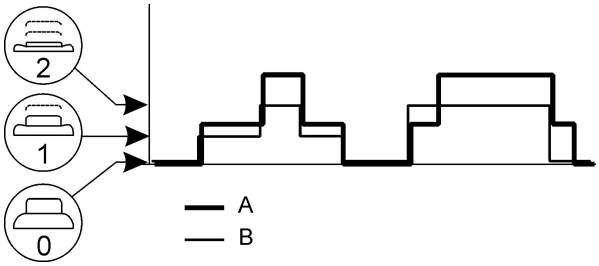
5.6 Starting and stopping through slow speed (2 speed application only)

Starting the motor directly in high speed will cause a high starting current that heats up the motor quite rapidly. To prevent the motor from overheating, the hoist-monitoring unit will always start the motion in slow speed. After a short period of time, the hoist-monitoring unit allows driving in fast speed when requested.

Stopping the motion directly from high speed will cause excessive brake wear. To protect the brake lining material, the hoist-monitoring unit will initiate slow speed for a brief moment, before the mechanical brake is closed.

☞ This function can only be activated in two-speed systems



A. Speed
B. Position of pushbutton (0, 1, 2)

5.6.1 Starting and stopping through slow speed instructions

Starting and stopping through slow speed parameters

Param.	Value	Description	Note
4-7Load param		Load calculation menu	Accessible with password 4: 8124
4-7-13	0.20s	Acceleration time from stop to slow speed 0.00s – 1.00s	See description below
4-7-14	0.30s	Acceleration time from slow speed to fast speed 0.00s – 1.00s	See description below

The parameters 4-7-13 and 4-7-14 have the following functions:

- During acceleration from zero to slow speed and deceleration from slow speed to zero, the unit will not calculate or supervise the overload protection and current measurement for a period of time determined by parameter 4-7-13.
- During acceleration from slow speed to fast speed and deceleration from fast speed to slow speed, the unit will not calculate or supervise the overload protection and current measurement for a period of time determined by parameter 4-7-14.
- The above function prevents the overload from tripping during the acceleration and deceleration moment, especially in two-step systems with motor-torque calculation based overload protection, since the starting currents are momentarily quite high.
- When accelerating from zero directly to fast speed, the motion starts in slow speed for a period determined by par. 4-7-13.
- When decelerating from fast speed to slow speed, the unit will keep the fast speed active for a period determined by par. 4-7-14.
- When decelerating from fast speed directly to zero, the unit will activate the slow speed for a fixed period of 250ms (not adjustable by parameters!).

The above function prevents the use called as “inching”, “jogging” or “tipping” operation.

☞ Once the slow speed output is activated, it remains active for 250ms, even if the input command drops off within this time. This prevents the directional contactors to drop off during the high starting currents.

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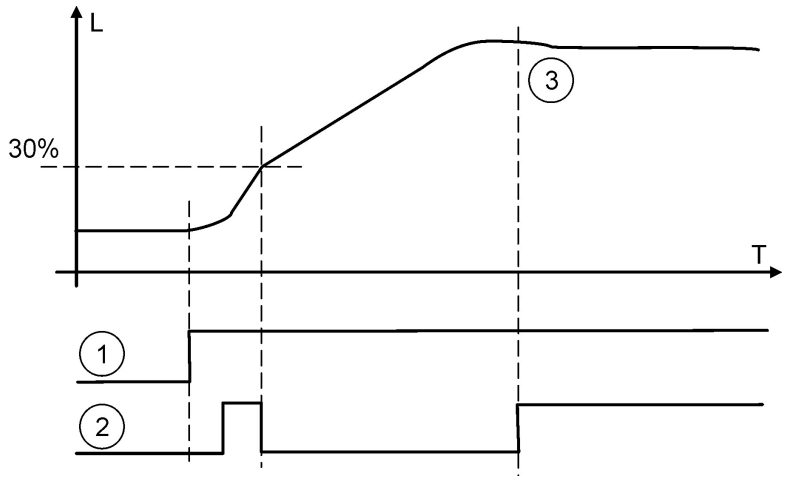
5.7 Sudden load increase supervision

In case the hoist-monitoring unit measures a sudden load increase when driving upwards in high speed, the unit will control the hoist to low speed. A sudden load increase is considered when the load exceeds 30% of the rated load of the hoist within 200ms. High speed hoisting is allowed again when the load increase in the last 200ms is less than the preset value, determined by parameter 4-7-2.

The function is completely reset when the measured load is less than 10% of the rated load of the hoist. The function has no effect when the load is bigger than 30% of the rated load of the hoist. Sudden load increase may occur e.g. due to jerky movements or starts in high speed.



L. Load
T. Time
1. First speed
2. Second speed
3. Load increase stops

☞ This function can only be activated in two-speed application and hoist has no effect when hoisting in low speed. Sudden load increase supervision is only activate with loads below 30% of rated load and is activated only once.

5.7.1 Sudden load increase supervision instructions

Sudden load increase supervision parameters

Param.	Value	Description	Note
4-7 Load param		Load calculation menu	Accessible with password 4: 8124
4-7-2 Load rate%	10	Load increase rate for controlling the hoisting in two step control, speed change to fast speed is allowed when actual load change within 200ms < parameter 4-7-2. Setting range: 0…10%, steps of 1%	0% means that the function is not applied 10% is the factory default

A small value makes the hoist to drive in slow speed for a longer period, to ensure that the load is stabilised (not stuck to the unloading platform etc. and no more vibrations caused by the ropes and/or other mechanics).

A larger value (maximum 10) allows faster acceleration to fast speed.

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6 Monitoring Items

6.1 General

In order to read the monitoring items and to program the unit, the hoist-monitoring unit is equipped with a display. The monitoring items of the hoist-monitoring unit consist of variable read-only values. These monitoring items are of great advantage when efficiently planning maintenance, preventive repairs, troubleshooting and general overhauls. In addition, the monitoring values will accurately show the usage of the hoist.

The values are stored in the memory of the hoist-monitoring unit. The stored values remain also during power-off situations. After power-off situation the previously stored values are taken into account when new values are calculated.

☞ The condition monitoring items can only be read after a correct password has been given. The manufacturer will provide a personal password with each delivery that has been acquired with this option.

1	**Monitor 1**		**Read only menu for condition monitoring values and measured values. Accessible with the customer's password.**

Param.	Name	Value	Description
1-1	**Cond mon**		**Condition monitoring menu**
1-1-1	SWP%	"n" %	Remaining Safe Working Period of the hoist in percentage, starting from 100%. When the SWP counter descends to 0% (or even negative), a General Overhaul must be carried out.
1-1-2	Starts	"n"	Total number of starts of the hoist in either up or down direction. *1)
1-1-3	Run time	"n" h	Total running time of the hoist in hours. *2)
1-1-4	Cycles	"n"	Total number of hoisting cycles. *1). The number increases by one, when a load value increase more than 20% of the rated load is lifted.
1-1-5	Mean load	"n.n" t	Average of the handled load during the recorded cycles.
1-1-6	Br SWP%	"n" %	Remaining Safe Working Period of the brake in percentage. The SWP for the brake is calculated according to the number of Starts and E-stops (also stops at limit switch).

6.2 Primary monitoring items

The primary monitoring items are according to the ISO and FEM regulation. Depending on the hoist duty class, the hoist is given an initial Safe Working Period (SWP). The SWP counts down according to a calculation, which includes the running time with a certain load. Also the total run-time (independent on the load) and the amount of starts are directly related to the hoist's duty class and theoretical lifetime.

The primary monitoring items, related to the FEM and ISO regulations are:
- Hoist Safe Working Period counter (SWP%)
- Starts counter
- Run Time counter

☞ Monitoring items can only be read if the hoist-monitoring unit is equipped with a display, either mounted on the unit or in the pushbutton station.

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Relation between the hoist duty class and the primary monitoring items:

Class code	Hoist duty class		Starts [n]	Run time [hr.]	SWP / SRT3 [hr.]	SWP / SL3 [n]
	ISO	FEM	Par. 1-1-2	Par. 1-1-3	Par. 2-13	Par. 2-17
3	M3	1Bm	480.000	3.200	400	10.000
4	M4	1Am	1.134.000	6.300	800	24.000
5	M5	2m	3.000.000	12.500	1.600	64.000
6	M6	3m	7.500.000	25.000	3.200	160.000
7	M7	4m	18.000.000	50.000	6.300	378.000
8	M8	5m	42.000.000	100.000	12.500	750.000

6.2.1 Starts counter

The Starts counter counts the number of instants the hoist is started. A start is counted when the run command output (either hoisting or lowering) is activated, and the run feedback becomes active. If only run command input is activated then a start is not counted.

The maximum allowed number of starts is directly related to the theoretical lifetime of the hoist. When the Starts counter reaches the design limit value, an adequate overhaul must be performed. See the specific actions from the hoist GO manual. The hoist-monitoring unit will not prevent running the hoist when the Starts counter reaches the design limit value, but it will give a warning signal, indicating that safe usage of the hoist is no longer guaranteed.

6.2.2 Run Time counter

The Run Time counter records the total amount of hours the hoist has been running, either upwards or downwards.

The Run Time counter is not load dependent. The maximum allowed run time is directly related to the theoretical lifetime of the hoist. When the Run Time counter reaches the design limit value, an adequate overhaul must be performed. See the specific actions from the hoist GO manual. The hoist-monitoring unit will not prevent operating the hoist when the Run Time counter reaches the design limit value, but it will give a warning signal, indicating that safe usage of the hoist is no longer guaranteed.

6.2.3 Safe Working Period counter (SWP%)h

The theoretical lifetime of the hoist is presented as Safe Working Period (SWP). The SWP is based on a calculation, including the running hours and the load in the equation. The hoist-monitoring unit displays the SWP in percentage of the initial value. A new hoist is given a SWP value of 100%, which is in respect to the initial SWP-hours value according to the hoist duty class. When the SWP counter reaches zero, a general overhaul must be performed, after which the hoist shall be given a new SWP. See the specific actions from the hoist GO manual. The hoist-monitoring unit will not prevent running the hoist when the SWP reaches zero, but it will give a warning signal, indicating that safe usage of the hoist is no longer guaranteed.

$$SRT3_{n+1} = \sum_{i=1}^{n+1}\left(\Delta tf_i + \frac{\Delta ts_i}{SR}\right)\left(\frac{load_i}{nom.load}\right)^3 \qquad SL3_{l+1} = \sum_{k=1}^{l+1}\left(\frac{load_k}{nom.load}\right)^3$$

$$SWPRT\% = \frac{(D\_SRT3 - SRT3)}{D\_SRT3}\cdot 100\% \qquad SWPHC\% = \frac{(D\_SL3 - SL3)}{D\_SL3}\cdot 100\%$$

$$SWP\% = \min\{SWPRT\%, SWPHC\%\}$$

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SRT3	Load sum with hoist running time, third power. The parameter 2-13
I	Time period number (Time period is 0,1s)
Δtf_i	Run time in fast speed with $load_i$
Δts_i	Run time in slow speed with $load_i$
SR	Speed ratio. Two-speed systems: slow-fast (i.e. 6); Inverter drives: always 1
$load_i$	Actual load in period i.
nom.load	Hoist's nominal load. The parameter 6-4
SL3	Load sum with hoist cycles, the third power. The parameter 2-17.
$load_k$	The load difference between maximum load and initial load within the hoist cycles k
k	Hoist cycles number
SWPRT%	SWP% value calculated with hoist running time. The parameter 2-12
D_SRT3	Designed running hours, power three. The parameter 6-10
SWPHC%	SWP% value calculated with hoist cycles. The parameter 2-15.
D_SL3	Designed constraint for hoisting cycles, power three. The parameter 6-12
SWP%	Remaining Safe Working Period of the hoist in percentage, starting from 100%. The parameter 1-1-1.

SWP% is calculated when the parameter 2-13 SRT3 and the parameter 2-17 SL3 are known.

Example. The parameters 2-13 SRT3 is 163h; the parameter 2-17 SL3 is 3780 and hoist duty class is M4

$$SWPRT\% = \frac{(800-163)}{800}\cdot 100\% = 79{,}6\% \qquad SWPHC\% = \frac{(24000-3780)}{24000}\cdot 100\% = 84{,}25\%$$

SWP% = min {SWPRT%, SWPHC%}= 79,6%

☞ When SWP% is known the parameter 2-13 SRT3 and the parameter 2-17 SL3 can be calculated. See section **"Replacement instructions"** of this manual.

6.2.4 Hoist cycles counter

Total number of hoisting cycles. The number increases by one, when the hoist is started to down direction if a load difference was bigger than 20% of the rated load between a maximum load and a initial load within the last hoisting motion.

6.2.5 Run time and start counter for trolley and bridge

In addition to the hoist run-time and starts counter, the hoist-monitoring unit can be programmed to count the total run-time and starts of either the trolley and/or bridge travel motion. When this option is activated, a complete overview of the usage of the crane is recorded.

1	**Monitor 1**		**Read only menu for condition monitoring values and measured values. Accessible with the customer's password.**

Param.	**Name**	**Value**	**Description**
1-1	**Cond mon**		**Condition monitoring menu**
1-1-7	MFI1 RT	"n" h	Total hours of running time, when MFI1 input is closed. Can be used to monitor the total running time of another machinery (i.e. the trolley drive). Active only if parameter 4-1-1 is set to *"ST/RT"* and the MFI1 input is connected.
1-1-8	MFI1 ST	"n"	Total amount of starts, when MFI1 input is closed. Can be used to monitor the total amount of starts of another machinery (i.e. the trolley drive). Active only if parameter 4-1-1 is set to *"ST/RT"* and the MFI1 input is connected.
1-1-9	MFI2 RT	"n" h	Total hours of running time, when MFI2 input is closed. Can be used to monitor the total running time of another machinery (i.e. the bridge drive). Active only if parameter 4-2-1 is set to *"ST/RT"* and the MFI2 input is connected.
1-1-10	MFI2 ST	"n"	Total amount of starts, when MFI2 input is closed. Can be used to monitor the total amount of starts of another machinery (i.e. the bridge drive). Active only if parameter 4-2-1 is set to *"ST/RT"* and the MFI2 input is connected

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6.3 Measured values

The measured values allows maintenance analysis.

☞ A dot will appear on the correct spot to indicate the decimals

Param.	Name	Value	Description
1-2	**Measure**		**Measurement menu**
1-2-1	Act. Load	"n.n" t	The measured actual load value of the solo hoist connected to the unit.
1-2-2	Temp 1	"nnn" C	Temperature measured at thermistor input 1. Only functional when par. 4-4-1 is set to ""x"NTC" and a NTC-type of thermistor is connected across terminals X2: 21-22. Otherwise the display shows "NA" (Not Available)
1-2-3	Temp 2	"nnn" C	Temperature measured at thermistor input 2. Only functional when par. 4-5-1 is set to ""x"NTC" and a NTC-type of thermistor is connected across terminals X2: 23-24. Otherwise the display shows "NA" (Not Available)
1-2-4	Supply L1	"nnn" V	RMS line voltage of phase L1, measured at terminal X1: 19; VAC
1-2-5	Supply L2	"nnn" V	RMS line voltage of phase L2, measured at terminal X1: 17; VAC
1-2-6	Supply L3	"nnn" V	RMS line voltage of phase L3, measured at terminal X1: 15; VAC
1-2-7	Motor I1	"nn.n" A	RMS motor current of phase U. Only functional when par. 4-7-1 is set to "Motor"
1-2-8	Motor I2	"nn.n" A	RMS motor current of phase V. Only functional when par. 4-7-1 is set to "Motor"
1-2-9	Motor I3	"nn.n" A	RMS motor current of phase W. Only functional when par. 4-7-1 is set to "Motor"
1-2-10	Ain1 value	"n.nn" V	Measured voltage at analogue input AIN1. Voltage across terminals X2: 26-30; VDC
1-2-11	Ain2 value	"n.nn" V	Measured voltage at analogue input AIN2. Voltage across terminals X2: 27-30; VDC
1-2-12	Ain3 value	"n.nn" V	Measured voltage at analogue input AIN3. Note that there is no function behind AIN3. This input can be used for measurement purposes only
1-2-13	Int. temp	"n" C	Internal temperature of the unit.
1-2-14	Input	i.e.: 10101	Indicates the status of the inputs: HIN, LIN, FIN, MFI1 & MFI2. "1" means active, "0" means inactive. Note that the leftmost "zeros" before the first appearing "1" are not displayed
1-2-15	Output	i.e.: 10100	Indicates the status of the outputs: HOUT, LOUT, FOUT, RS & ROUT. "1" means active, "0" means inactive. Note that the leftmost "zeros" before the first appearing "1" are not displayed
1-2-16	Supply f	50	Supply voltage frequency (50 or 60Hz)

Param.	Name	Value	Description
1-3	**Min/Max**		**Minimum / maximum value menu**
1-3-1	Min supply	"nnn" V	Minimum measured value of the supply line voltage RMS.
1-3-1	Reset ?	"nnn" V	Resets the value shown in parameter 1-3-1 by pushing the ENT button twice
1-3-2	Max supply	"nnn" V	Maximum measured value of the supply line voltage RMS.
1-3-2	Reset ?	"nnn" V	Resets the value shown in parameter 1-3-2 by pushing the ENT button twice
1-3-3	Min Int. T	"n" C	Minimum measured value of the internal temperature of the unit.
1-3-3	Reset ?	"n" C	Resets the value shown in parameter 1-3-3 by pushing the ENT button twice
1-3-4	Max Int. T	"n" C	Maximum measured value of the internal temperature of the unit.
1-3-4	Reset ?	"n" C	Resets the value shown in parameter 1-3-4 by pushing the ENT button twice

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7 Optional functions

7.1 General

The hoist-monitoring unit can be equipped with a number of additional features. Each one of the features can, under certain restrictions, be chosen during the ordering process of the hoist, or added in afterwards. Contact a service agent authorised by the manufacturer for further details.

☞ Slack rope feature only functions properly when a load-handling device is attached to the hook. It is not recommended to activate the Slack rope function if no load-handling device is present.

7.2 Slack rope protection

The slack rope protection prevents lowering the hook when the measured load descends under a pre-set load limit. When slack rope occurs during lowering, the motion will be stopped according to the normal stopping sequence. Movement in upward directions is allowed, and will reset the slack rope protection. The slack rope protection can by by-passed by programming either one of the multi-functional inputs (MFI1 or MFI2).

☞ SW 2.100 or later: When slack rope function is activated the unit shows “Fault Srope” on the display. If unit’s software is SW 2.004 or earlier the unit doesn’t show anything when slack rope is activated and lowering is prevented.

☞ The slack rope by-pass function requires an additional selector switch or by-pass button (e.g. on the pendant station).

7.2.1 Slack rope protection instructions

Slack rope protection parameters

Parameter	Value	Description	Note
4-1 MFI1			Accessible with password 4: 8124
4-1-1 MFI1 oper.	Srope	Slack rope by-pass	It is recommended to connect a switch to the multi functional input in order to temporarily by-pass the slack rope function, in order to be able to perform repairing actions (replacing hoisting ropes etc.) and to swap load handling device (when applicable). If the by-pass function is not required, set this parameter to *“NU”*

☞ If the MFI1 input is already in use for another function, use the MFI2 for the by-pass switch and set parameter 4-2-1 to ***“Srope”***.

Parameter	Value	Description	Note
4-9 Slack rope			Accessible with password 4: 8124
4-9-1 SR select	Yes	Selects the slack rope function	
4-9-2 Load limit	“n” t	Sets the slack rope limit. When the measured load is less than the limit, lowering is prevented. Range 0…rated load of the hoist.	In practice, the minimum value is about 10% of the rated load of the hoist, or higher.

☞ A right Slack Rope level must be adjusted during the commissioning of the hoist.

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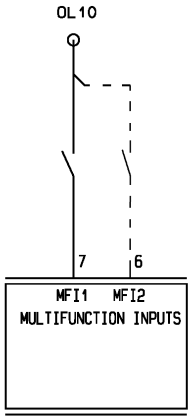
7.2.2 Slack rope protection connections

☞ Only if by-bass function is needed for Slack rope-function.

A “normally open” contact should be connected to either one of the multi-functional inputs.

The slack:

MFI1 or MFI2	Active load limit rope by-pass function operates according to the following logic
ON	Slack rope by-pass function active (lowering allowed)
OFF	Slack rope function active (lowering prevented when the load is below the set limit)



7.3 Intermediate load limits

In addition to the normal overload protection function, one, two or three intermediate load limits can be selected. An intermediate load limit will prevent the hoisting motion when the measured load exceeds the pre-set limit. The intermediate load limit operation is selected by assigning this function to one or both multi-functional inputs.

7.3.1 Intermediate load limits parameters

Parameter	Value	Description	Note
4-1 MFI1			**Accessible with password 4: 8124**
4-1-1 MFI1 oper.	IntL	Selects the intermediate load function for MFI1	
4-1-2 MFI1 IntL	”n” t	Sets the intermediate load level in tons. Range: 0.0t…hoist rated load	

Parameter	Value	Description	Note
4-2 MFI2			**Accessible with password 4: 8124**
4-2-1 MFI2 oper.	IntL	Selects the intermediate load function for MFI2	
4-2-2 MFI2 IntL	”n” t	Sets the intermediate load level in tons. Range: 0.0t…hoist rated load	
4-2-3 1+2 IntL	“n” t	Sets the intermediate load level in tons. Range: 0.0t…hoist rated load	The third intermediate load can only be activated when both MFI1 and MFI2 are selected for the intermediate load function.

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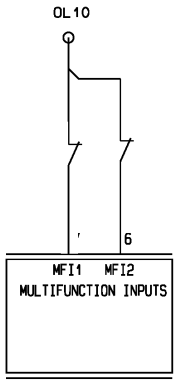
7.3.2 Intermediate load limits connections

One or two “normally closed” contact should be connected to the multi-functional inputs. The contacts can either be manual switches, or automatically actuated according to the position of the crane.

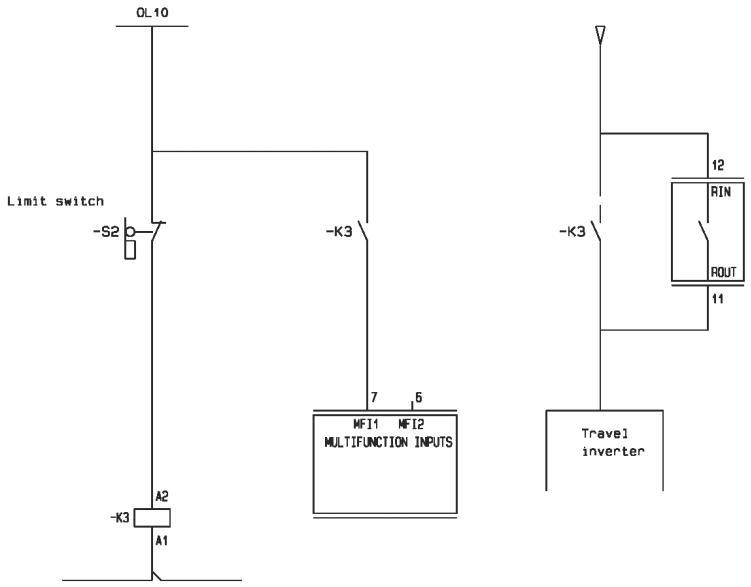
The intermediate load function operates according to the following logic:

MFI1 oper.	MFI2 Oper	MFI1 status	MFI2 status	Active load limit
NU	NU	-	-	Normal Overload limit
IntL	NU	ON	-	Normal Overload limit
IntL	NU	OFF	-	MFI1 load limit. The parameter 4-1-2
NU	IntL	-	ON	Normal Overload limit
NU	IntL	-	OFF	MFI2 load limit, The parameter 4-2-2
IntL	IntL	ON	ON	Normal Overload limit
IntL	IntL	ON	OFF	MFI1 load limit. The parameter 4-1-2
IntL	IntL	OFF	ON	MFI2 load limit. The parameter 4-2-2
IntL	IntL	OFF	OFF	MFI1+2 load limit. The parameter 4-2-3



☞ The hoist-monitoring unit will prevent the hoisting motion when the measured load exceeds 110% of the intermediate load for a period of time. The overload protection is reset when the measured load decreases to 80% of the intermediate load.

Connections if this function is used to do a load limited area



7.4 Run time and start counter for trolley and bridge

In addition to the hoist run-time and starts counter, the hoist-monitoring unit can be programmed to count the total run-time and starts of either the trolley and/or bridge travel motion. When this option is activated, a complete overview of the usage of the crane is recorded.

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7.4.1 Run time and start counter for trolley and bridge parameters

Parameter	Value	Description	Note
4-1 MFI1			**Accessible with password 4: 8124**
4-1-1 MFI1 oper.	ST/RT	Start counter and run-time counter	Counts the amount of times the MFI1 input becomes active (starts) and the total time the MFI1 input is active (run-time)

Parameter	Value	Description	Note
4-2 MFI2			**Accessible with password 4: 8124**
4-2-1 MFI2 oper.	ST/RT	Start counter and run-time counter	Counts the amount of times the MFI2 input becomes active (starts) and the total time the MFI2 input is active (run-time)

Parameter	Value	Description	Note
1		**Monitor 1**	**Accessible with password 1**
1-1-7 MFI1 RT	"n"h	Displays the total time MFI1 has been active (run-time counter)	Read only value
1-1-8 MFI1 ST	"n"	Displays the amount of times MFI1 has been activated (starts counter)	Read only value
1-1-9 MFI2 RT	"n"h	Displays the total time MFI2 has been active (run-time counter)	Read only value
1-1-10 MFI2 ST	"n"	Displays the amount of times MFI1 has been activated (starts counter)	Read only value

7.4.2 Run time and start counter for trolley and bridge connections

A normally open contact of the trolley and/or bridge travel brake contactor is connected to the MFI1 and/or MFI2 input. Without a brake contactor the control command can be duplicated to the MFI1 and/or MFI2 input.

7.5 Analogue output

The hoist-monitoring unit has one analogue output, which can be used for e.g. a load display or a relay board that provides certain relay operations according to the load value. The analogue output has a voltage range of 0…10 VDC. The analogue output can be programmed to represent either the actual load (or sum load in multi-hoisting), the tared load (or summed tare load in multi-hoisting) or the actual load of the connected hoist.

7.5.1 Analogue output parameters

Parameter	Value	Description	Note
4-6 AOUT		**Analogue output parameters**	**Accessible with password 4: 8124**
4-6-1 AOUT oper.	Act Tare Solo	Actual load's values in the output Tared Load's values in the output Solo hoist's load values in the output, Parameter 1-2-1	Actual sum load in multi hoisting application. Tared sum load in multi hoisting application. Tare function is made for each hoist individual; means tare command is not transferred to other units via CAN bus. Same function as in the display.
4-6-2 Zero load	2.00V	Analogue output voltage with zero load	Adjustable according to the needed voltage of the connected device when required. *1)
4-6-3 Nom. Load	8.00V	Analogue output voltage with rated load. Refer to parameter 6-4 for the rated load in single hoist operation Refer to parameter 4-11-4 for the rated load in multi-hoist applications	Adjustable according to the needed voltage of the connected device when required. *2)

*1) The zero load voltage should be higher than 0.00V in order to achieve "broken wire protection"
*2) The rated load voltage should be less than 10.0V in order to allow overload indication.

☞ Reliable ranges are from 2V to 8V with large display and from 1V to 9V with other devices e.g. PLC equipments.

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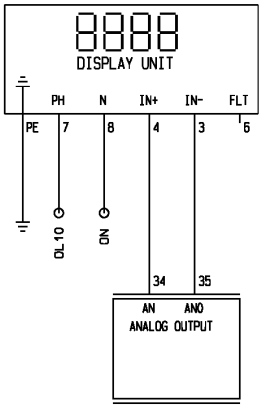
7.5.2 Analogue output connections

The load display (or other device) is connected to the analogue output terminals AN and ANO (terminals 33 and 34). The connected device must have an input resistance of at least 1kΩ in order to prevent the analogue output being overloaded.



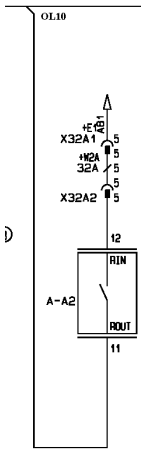
☞ The analogue output has a filtering delay of 1000ms before SW 2.100. In the SW 2.100 and the later SW the filtering delay is 200ms to enable faster update of load information.

Consult on the specifications of the connected device for the minimum and maximum required voltage range (difference between zero load voltage and rated load voltage), and upper and lower limits.

7.6 Free relay output

The hoist-monitoring unit has one free relay output, connected between terminals 11 and 12, which can be programmed to operate under the following conditions:

Overload
Load limit
OK/Warning/Fault
Ready/Fault
Motor over temperature



Connected to the relay output can be any signalling device (optical or acoustic) or an additional control circuit to react on any of the above situations.

☞ Note that only one of the options can be chosen at a time.

Relay's switch's technical data: 230VAC; 3A

Free relay output parameters

Parameter	Value	Description	Note
4-3 ROUT		**Relay output parameters**	**Accessible with password 4: 8124**
4-3-1 Rout oper.	NU	Not used	Relay output does not operate
	OL	Overload Contact closed when overload is detected.	Operates simultaneously with the overload protection Bridge overload activates also the overload function in the relay output from software 2.100.
	LoadX	Load limit Contact closed when the load exceeds the limit "X", where the limit is determined by parameter 4-3-3	Operates only according to the measured load of the solo hoist connected to the unit
	OK	Fault- and warming –state supervision Contact closed in normal operation Contact blinks when the units shifts to *"warning state"* Contact open when the unit shifts to *"fault state"*	Operates simultaneously with the red LED on the unit
	Ready	Fault supervision Contact closed in normal operation Contact open when the unit shifts to *"fault state"*	Operates simultaneously with the red LED on the unit
	TempX	Motor overtemperature Contact closed when the motor temperature exceeds the limit "X", where the limit is determined by parameter 4-3-5	Can only be selected when the motor is equipped with NTC-type of temperature sensors (see parameter 4-5-1)

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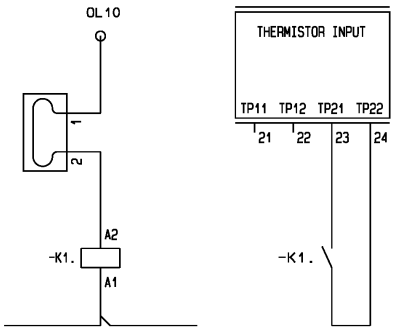
Parameter	Value	Description	Note
4-3-2 ROUT logic	Norm	Selects the operation logic of the relay. Normal operation is as described above	When the operation logic has to be inverted, set this parameter to **"Inv"**
4-3-3 ROUT loadX	"n" t	Sets the load limit "X" in tons, when the option "LoadX" is selected. Setting range: 0.0t…rated load of the hoist	The upper limit is the rated load of the solo hoist connected to the unit.
4-3-4 TempX meas	T1 T2 T1+2	Selects the temperature measurement. **"T1"** temperature measurement T1 determines the operation of the relay (typically the low speed windings) **"T2"** temperature measurement T2 determines the operation of the relay (typically the high speed windings) **"T1+2"** both T1 and T2 are used. When either one reach the limit, the relay operates.	See also the settings of parameters 4-4-1, 4.5.1, 4-7-6 and 4-7-7
4-3-5 TempX lim	"n" C	Sets the motor temperature limit in Centigrade	In practice the limit should be less than the temperature set by parameter 4-10-2

7.7 Hoist brake-wear supervision

The unit can be programmed to supervise the brake wear. This option requires a type of brake with a built in brake-wear sensor and can only be used when the load measurement system is sensor based (thus not with motor torque calculation systems). When the unit measures excessive break wear, the motion will be stopped.

7.7.1 Hoist brake-wear supervision instructions

This option requires a brake wear sensor like commonly used in XL-hoisting brakes, or an additional micro-switch that supervises the airgap of the brake. The sensor is connected to the temperature measurement input T1 (TP11 & TP12) or T2 (TP21 & TP22).



Hoist brake-wear supervision parameters

Parameter	Value	Description	Note
4-4 T1		**T1 parameters**	**Accessible with password 4: 8124**
4-4-1 T1 operat.	Bwear	Activates the brake wear supervision, when connected to the T1 input.	Worn brake (thus open contact) will stop the motion and "Fault, Br wear" indication appears on the display.

☞ In case the T1 input is in use for another function, connect the sensor to the T2 input and set parameter 4-5-1 to ***"Bwear"***

☞ It is recommended to set parameter 4-10-1 to: ***"Down"*****,** in order to allow lowering the load when the brake-wear supervision is activated. Note that this will also allow lowering when the overtemperature is activated, because parameter 4-10-1 determines the operation of both the T1 and T2 inputs!

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7.8 Load tare

With an additional switch, the monitored load on the display can be tared (tared load value is set to zero). This option is most useful when the hoist is equipped with the display in the push-button station, or when the crane is equipped with an additional load display.

7.8.1 Load tare instructions

An additional switch or pushbutton must be connected to either one of the MFI-inputs. Closing the switch will set the tared load value to zero.

Load tare instructions parameters

Parameter	Value	Description	Note
4-1 MFI1			**Accessible with password 4: 8124**
4-1-1 MFI1 oper.	Tare	Activates the load tare function	Closed contact will set the tared load to zero

☞ In case the MFI1 input is in use for another function, connect the switch to the MFI2 input and set parameter 4-2-1 to “Tare”

7.9 Levelling function

The levelling function is a feature especially designed for multi-hoist applications, where the positions of the hooks are balanced in the upper position. This function is most useful when the crane is handling fixed or similar known loads, such as containers or long objects.

In normal operation, both hoist will stop the motion when either one of the hoist-monitoring units detects a fault or is stopped by a limit switch. This prevents the load from tilting.

The levelling function allows each hoist individually to continue hoisting close to the upper limit switch until the hooks are balanced.

7.9.1 Levelling function instructions

To activate the levelling function, an additional levelling limit switch has to be connected to either one of the MFI-inputs.

Levelling function parameters

Parameter	Value	Description	Note
4-1 MFI1		MFI1 parameters	Accessible with password 4: 8124
4-1-1 MFI1 oper.	Level	Activates the levelling function in multi-hoist applications	

☞ In case the MFI1 input is in use for another function, connect the switch to the MFI2 input and set parameter 4-2-1 to “Level”

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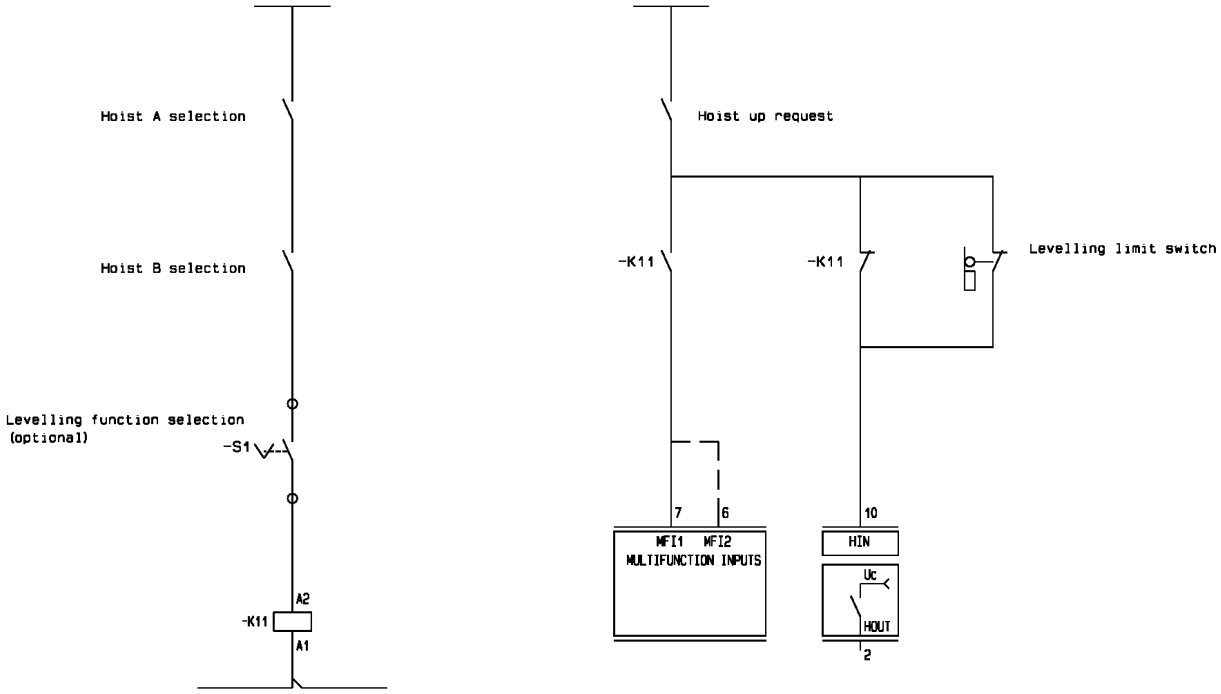
7.9.2 Levelling Function Connections

MFI1: For the levelling function MFI1 (or MFI2) can be used. For the desired function the parameter setting must be 4-1-1 MFI1 oper. (or 4-2-1 MFI2 oper.) = Level

Single hoist selection: The switch must be closed if only one of the hoist is run without the levelling function. If the switch is open (as in the drawing) the hoist request is forwarded directly to the MFI1 and through the levelling limit switch to HIN.

Limit switch: When the hoist reaches the levelling limit, the switch cuts off the HIN line resulting the hoist to stop in the normal way. MFI1, however, still has the hoist up request and it forwards this information to all other units through the CAN bus so that they can continue hoisting until they also reach their levelling limit or the hoist up request goes off.



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8 Multi-hoisting

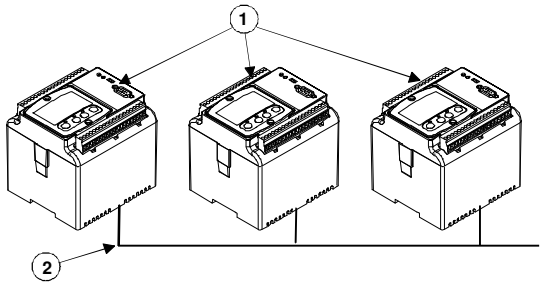
8.1 General

Up to five units can be connected together with a CAN bus. The communication is tailored for the hoist applications and is restricted for the hoist monitoring units only. It is not possible to add any other CAN units to this bus.

Several functions are realised via CAN bus. Each unit indicates the status information and the load of the hoist for all other units connected with the CAN bus. With this data two type of supervisions are done: run supervision and sum overload protection. The run supervision makes sure that if several hoists are running and one makes an uncontrolled stop, all other hoists are stopped as well. The sum overload protection is mainly used for the bridge overload protection in such cases where the total sum load of the individual hoists is bigger than the nominal load of the bridge.

There is no CAN bus master to collect all the information and make the needed supervisions. Instead, all units see the status and load information of every other units and each unit carries out the similar supervisions. Thus there are as many supervision units as stations connected to the CAN bus.

In addition to the status and load information, parameter values are transferred in the CAN bus. Every unit is able to ask parameter values from any other unit. This makes it possible to read with the display unit the parameter values of any other connected unit.



1. Maximum 5 units
2. CAN bus

8.2 Multi-hoisting instructions

8.2.1 Multi-hoisting parameters

The CAN bus related parameters are presented in the table below. Note that the changes of the parameters in the group 4-11 Comm hoist take effect only after power off – power on reset. After switching the power on, the bus configuration is set and it must be fixed all the time. This means that it is not allowed to add any new stations or leave away any of the present stations.

Parameter	Value	Description	Note
6 Design		**Design values menu**	**Accessible with password level 6**
6-1 Hoist name	A…E	The identifying character for the hoist-monitoring unit	The address used in the CAN bus communication, each unit must have a unique address, a good practice is to name the units in the alphabetic order

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Parameter	Value	Description	Note
4-11 Comm hoist		**The settings for common hoisting**	**Accessible with password level 4**
4-11-1 Hoist cnt	2…5	The amount of units connected into the CAN bus	Each unit connected into the CAN bus must have the same number.
4-11-2 Run sup	Yes	Activates the multi-hoist supervision	If multi-hoist supervision is not required, set this parameter to "No"
4-11-3 B OL	Yes	Activates the bridge overload supervision	If bridge overload supervision is not required, set this parameter to "No"
4-11-4 B nom load	"n" t	Rated load of the crane	Overload detection has similar filtering as in the overload detection of an individual unit. This parameter scales the load information transferred in the CAN bus. Each unit connected into the CAN bus must have the same value.

8.2.2 Cabling

CAN bus is connected by three wires between the terminals as follows:

36	CAN-H	Differential high signal
37	CAN-L	Differential low signal
38	CAN-GD	Zero level for high and low signals

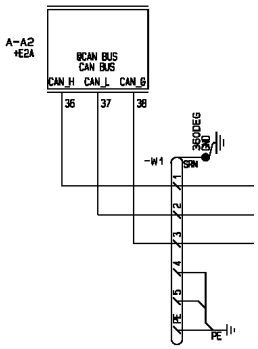
The connection is made one-to-one i.e. terminals 36 CAN-H of each unit are directly connected, 37 CAN-L and 38 CAN-GD similarly.

It is highly recommended to use shielded cable for the CAN bus. The cable shield is connected to the ground of the hoist. It is recommended to use 360 degrees shield clamps to carry out the grounding. Especially the shield should NOT be connected to the terminal 20 PE or 38 CAN-GD.

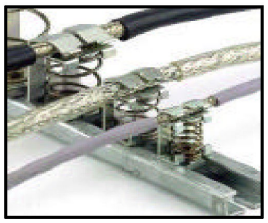
If the CAN bus is very short and the hoist –monitoring devices are located close to each other, also twisted cables can be used.

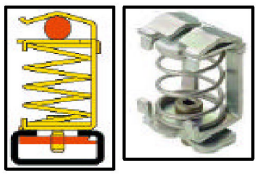
It is recommended to separate the bus cable from power cables. There should be enough free space or other type of isolation between the bus cable and power cables.

Theoretically the bus line can be over 1000 meters (~3000 ft) with the speed of 50 kbit/s. In practice, however, external disturbances, reflection waves, bus topology, termination exceptions etc. limits the maximum bus length.



How to connect the shielded cables





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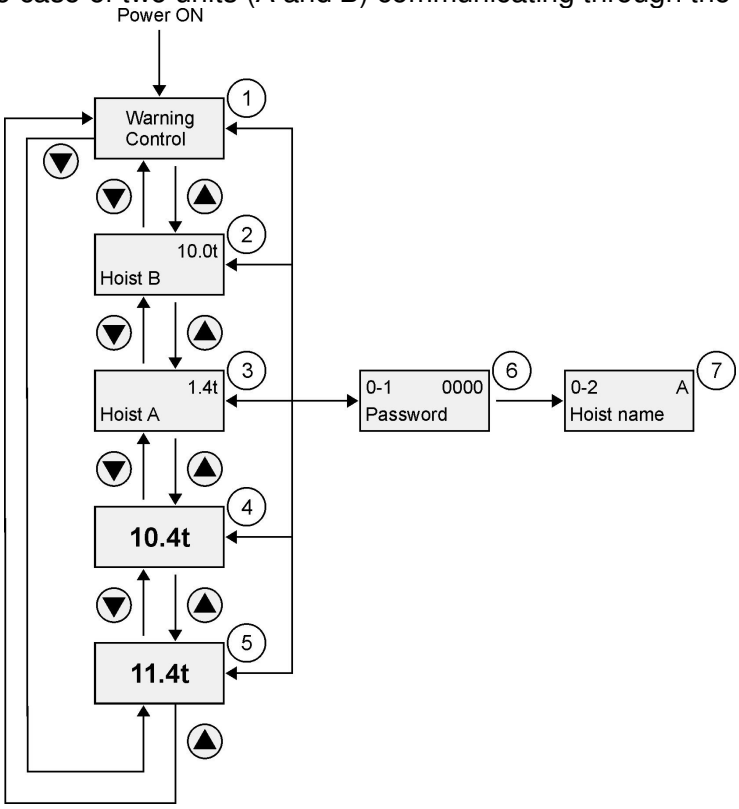
8.2.3 Menus through CAN bus

With CAN bus the load display with large digits indicates the sum load of all units working in the CAN bus. Even if the sum overload protection is not selected, the large digits show the sum load of all units. The actual load values of single units are shown with small digits. The figure below gives an example of the menu structure in the case of two units (A and B) communicating through the CAN bus.



1	When the power of the unit is switched on, the display indicates with the text if there exist an active warning (as in this example figure), or an active service warning, or an active fault. If no warning, service warning or fault is active, the display indicates the tared sum load after the power on (display number 4)
2	From the text display, pushing the up arrow key, the display moves to the load value of one unit (in this example unit B). If there are several warnings, service warnings or faults, those are displayed one by one after pushing the arrow key
3	Single unit loads are indicated for every unit working in the CAN bus. Change from one single load display to the next one is done with the arrow keys.
4	The sum load of the units is shown with large digits. When the yellow LED is illuminated the display shows the tared sum load. Each unit makes the tare individually and thus each unit can have different tared sum load values.
5	When the yellow LED is not illuminated, the large digits indicate the actual sum load of all units. The menu structure makes a circle and so with up key button it is possible to go back to the text mode display.
6	If the ENT key is pushed in one of the load display modes (display numbers 2, 3, 4 or 5), the display changes to the password request menu. With the ESC key or incorrect password the display return to the load display.
7	When the correct password is given in menu 0-1, the next menu is for the unit selection. As default the actual unit where the display is connected is given. Here it is possible to select some other unit connected with the CAN bus (unit B in this example). After selecting the unit, the menu structure works similarly independently of the unit selection. The display makes no difference if the value comes from the actual unit or through the CAN bus from another unit.

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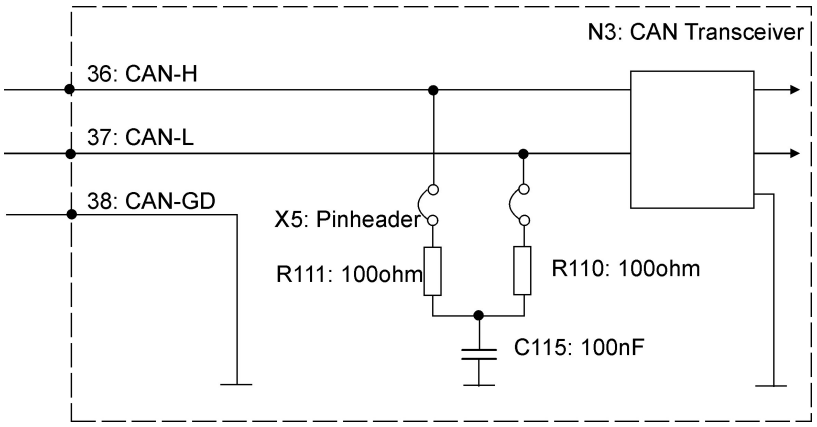
8.3 CAN-bus topology

Generally it is recommended that a CAN network should be as close as possible to a single line structure. Thus the bus cable should be one long line into which the stations are connected with short drop cables. Resistors must terminate both ends of the bus line.

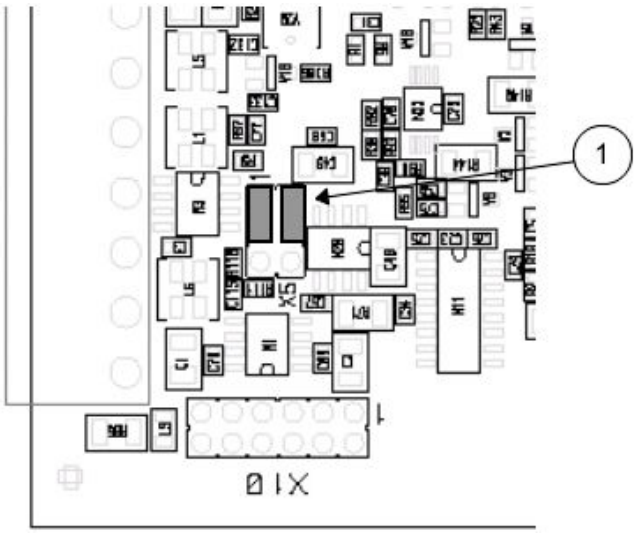
Also other topology options are possible. A star topology with three branches is suitable for a crane with three separate trolleys and hoists. The end of each branch must be terminated with a resistor.

8.3.1 Termination resistors

The unit includes the termination resistors. So called “split termination concept” with two resistors and one capacitor is employed. This means that one termination resistor is slip into two resistors of equal value (100 ohm). The centre tap is grounded via a capacitor (100nF). The termination resistors are connected through the jumpers X5.



As factory setting the termination resistors are connected. This means that two termination jumpers of the pin-header X5 located on the CPU board of the unit are connected to the upper position according to the figure below. If the termination is not desired, the jumpers are set to the lower position. This setting does not connect anything. The lower pins are only to keep the jumpers available when needed.



1. Default setting: termination resistors connected

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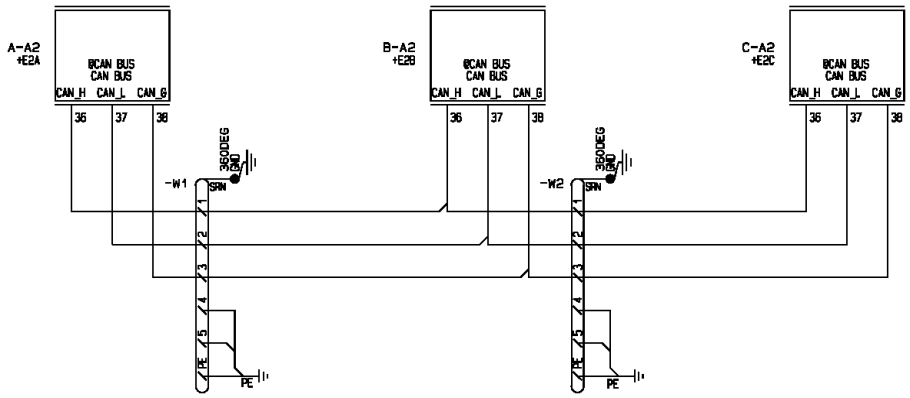
8.3.2 Recommended topologies

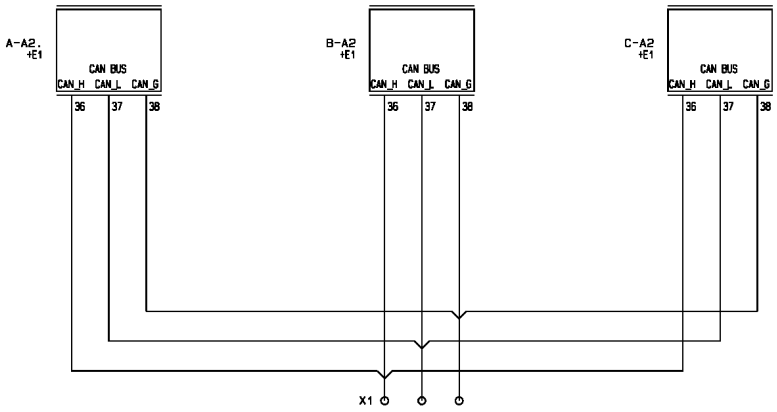
The table below provides the general recommendations for the CAN bus topology for different numbers of units connected together. When three units are connected the CAN bus can be a line type or a star type. The termination must be done at both ends but it seems to be no problem if also the middle unit connects the termination resistors in a line type topology. When 4 or 5 units are connected, then termination resistors must be removed from the middle units. If the CAN bus has 4 or 5 termination resistors, the total bus termination resistance decreases too much for the CAN transceiver.

No. units	Bus topology	Termination resistors
2	Line	Termination at both ends
3	Star	Termination at all 3 ends
	Line	Termination at all 3 nodes
4	Line	Termination at the ends, not in the middle
5	Line	Termination at the ends, not in the middle

Three units' CAN-bus is connected to line.



Three units' CAN-bus is connected to star.



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9 Commissioning

9.1 Start-up

- Check that the supply control voltage complies with the rated control voltage of the unit.
- Check that all electrical connections are done according to the delivered electrical diagrams.
- Switch the power on.
- Check that the hoists control method complies with the application (inverter control or two-speed control) with parameter 4-8.
- Make sure there is no load in the hook. Run the hoist both directions, slow speed and full speed for at least five seconds. Check that no messages appear on the display.

9.2 Load measure

☞ Check that hoists Load Measure type complies with the application (Motor or Load sensor in two-speed control) with parameter 4-7-1.

9.2.1 Load measure type by ”Motor”, (see the parameter 4-7-1)

- Check that the actual load value parameter 1-2-1 shows 0.00t ±10% from nominal load, when lifted only empty hook, up and down also slow- and fast speed.
- Check that the actual load value parameter 1-2-1 shows x.xxt ±10% from nominal load, when lifted test load up and down also slow- and fast speed

9.2.2 Load measure type by ”Sens.”, (see the parameter 4-7-1)

- Check that the actual load value parameter 1-2-1 shows 0.00t ±5% from nominal load, when lifted only empty hook.
- Check that the actual load value parameter 1-2-1 shows x.xxt ±5% from nominal load, when lifted test load.

When either of the measurements done under step 1 or 2 does not result in the required outcome, the load calibration procedure has to be carried out. Refer to chapters ***“Overload protection – Motor torque”*** or ***“Overload protection for load sensor”*** of this manual for instructions.

☞ When local regulations require a dynamic true overload test, follow the procedure as described by the local legislation.

When local regulations require a static overload test (110%…140% of rated load of the hoist), temporarily by-pass the overload function with parameter 3-5 (“OFF”). Be aware of mechanical restrictions and additional mechanical overload switches! When rated load is over 110% then hoisting is only possible with slow speed!

Check the function of the installed features.

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9.3 Functional checks

9.3.1 Multi hoisting

- Set parameter 4-11-1 to “1” and carry out the start-up procedure for the single hoist as described above in ***“Start-up”***
- Set parameter 4-1-1 back to “n” (where “n” is the number of unit connected to the CAN-bus).
- Check that all parameter values in the parameter group 4-11 “Comm hoist”, are equal in all units.
- Check the load display of all connected hoists via one unit. Refer to chapter ***“Sum load / solo hoist load mode”*** of this manual for instructions.

9.3.2 Multifunction inputs

Check the Multifunction Input 1 operation from the parameter 4-1-1 “MFI1 oper.” and the Multi Function Input 2 operation from the parameter 4-2-1 “MF2 oper.”.

NU	Not used
IntL	Intermediate load limit
Tare	Load tare
SRope	Slack rope by-pass
ST/RT	Start and run-time counter
2OLL	Second overload limit
Level	Levelling limit switch function in common hoisting
CintL	Intermediate load limit in common hoisting
CAN	CAN bus by-pass

9.3.2.1 Intermediate load limit ”IntL”

- Intermediate load limit is activated when input is not activated.
- When actual load values exceed a limit and the input is not activated then unit work similarly than the overload situation.
- Check by parameter 4-2-2 the intermediate load limit value.
- Check by parameter 1-2-14 that unit reads the input status.

☞ MFI1 input’s status bit is second bit from the right (XXX1X)

☞ MFI2 input’s status bit is first bit from the right (XXXX1)

9.3.2.2 Tare function ”Tare”

- The control unit must have a button or a switch for this function.
- Hang a load in the hook
- Check the display in tare load mode (yellow LED is illuminated)
- Push the “tare load” switch on the control station
- The value on the display should change to “0.0t”

9.3.2.3 Slack rope by-pass function ”Srope”

- The right action of Slack rope by-bass function checked at same as the slack rope function is tested.

9.3.2.4 Start and run time counter ”ST/RT”

- This function is start and run time counter for trolley and bridge.
- Select the parameter 1-1-10 or 1-1-8.
- Drive trolley (or bridge) several times.
- Check that the value shown with the parameter increases by one after each start.

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9.3.2.5 Second overload limit "2OLL"

- When MFI1 input is activated then the hoist can lift over the nominal load (1.00 – 1.30 x nom.).
- Check by parameter 1-2-14, that MFI1 status bit is 1 when lifted in the area where need lift more than nominal load.

9.3.2.6 Levelling function "Level"

- Drive one of the hooks higher upwards than the other(s)
- Select common hoisting with the selector switch on the control station.
- Drive all hooks upwards to the upper limit.
- When the highest hook stops, the other(s) should continue until the hooks are balanced

9.3.2.7 Bridge intermediate load limit "CIntL"

- Bridge intermediate load limit is activated when input is not active.
- When actual load value exceeds a limit and the input is not active the unit works similarly as in overload situation.
- Check bridge intermediate load limit value by parameter 4-2-5.
- Check that the hoist control device sees then the input status by parameter 1-2-14. MFI1 input's status bit is second bit from the right (XXX1X)

9.3.2.8 By-pass CAN-bus "CAN"

- The control unit must have a button or a switch for this functions.
- CAN bus by-pass function is activated when input is active.
- Test that the hoist control device sees the input status by parameter 1-2-14.

9.3.3 Functional free relay output ROUT

- Check the relay operation by parameter 4-3-1
- Check the operation logic of the relay by parameter 4-3-2. Normal operation is as described below.

9.3.3.1 Overload "OL"

- Contact closed when overload is detected.
- Check that the relay works.

9.3.3.2 Load limit function "LoadX"

- Contact closed when the load exceeds the limit "X", where the limit is determined by parameter 4-3-3
- Check the limit value from the parameter 4-3-3
- Check that the relay works.

9.3.3.3 Fault- and warning -state supervision "OK"

- Contact closed in normal operation
- Contact blinks when the unit shifts to "warning state"
- Contact opens when the unit shifts to "fault state
- Check that the relay works.

9.3.3.4 Fault supervision "Ready"

- Contact closed in normal operation
- Contact opens when the unit shifts to "fault state"
- Check that the relay works.

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9.3.3.5 Motor temperature limit "TempX"

- Contact closed when the motor temperature exceeds the limit "X"
- Check the limit value by parameter 4-3-5
- Check the input selection by parameter 4-3-4
- "T1" temperature measurement T1 determines the operation of the relay (typically the low speed windings)
- "T2" temperature measurement T2 determines the operation of the relay (typically the high speed windings)
- "T1+2" both T1 and T2 are used. When either one reach the limit, the relay operates.
- Check that the relay works.

9.3.4 Analog output AOUT

- Check the output operation by parameter 4-6-1.
- Check that load value is same on the unit's display as on the and large display
  - 4-6-1 Oper. is Act. then "Actual load mode" value should be same than large displays value
  - 4-6-1 Oper. is Tare. then "Tare load mode" value should be same than large displays value
  - 4-6-1 Oper. is Solo. then parameters 1-2-1 value should be same than large displays value
- If load value differs with empty hook the correct value is achieved by adjusting parameters 4-6-2
  - If the large display load value is bigger than unit's load value then decrease parameter 4-6-2 value
  - If the large display load value is lower than unit's load value then increase parameter 4-6-2 value
- If load value differs with test load on the hook the correct value is achieved by adjusting parameter 4-6-3
  - If the large display load value is bigger than unit's load value then decrease parameter 4-6-3 value
  - If the large display load value is lower than unit's load value then increase parameter 4-6-3 value

9.3.5 Slack rope

☞ Slack rope feature only functions properly when a load-handling device is attached to the hook. It is not recommended to activate the Slack rope function if no load-handling device is present.

The slack rope protection prevents lowering the hook when the measured load descends under a pre-set limit. When slack rope occurs during lowering, the motion will be stopped according to the normal stopping sequence. Movement in upward direction is allowed, and will reset the slack rope protection. The slack rope protection can be by-passed by programming either one of the multi-functional inputs (MFI1 or MFI2).

- Check the parameter 4-9-1 SR select, if "Yes"
- Check the load limit value by parameter 4-9-2. In practice, the minimum value is about 10% of the rated load of the hoist, or higher.
- Lower the hook carefully in slow speed onto a stable platform.
- The motion should stop.

☞ Pay attention to the rope coming from the drum. Make sure the rope does not jump out of the drum-grooves.

- Drive carefully in slow speed upwards, while guiding the rope coming from the drum by hand.
- If a slack rope by-pass switch is installed, check the function of it from the parameter 4-1-1 or the parameter 4-2-1. If either ones parameter value is "Srope" then do the following checks.

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- Check, from el.drawings if any by-pass function is designed. If yes, continue. (Designer might have activated slack ropes by-pass function parameter but the connections in el.drawings are done only when ordered.)
- Activate the input and lower the hook.
- The motion should run.

9.4 Commissioning table

Read the below parameters from the display and write them down in the table

☞ Keep this sheet in a safe place for future reference.

Hoist serial number:		**Date:**	
Hoist monitoring unit serial number:		**Name:**	

Param.	Name	Value
0-2	Hoist name	
1	**Monitor 1**	
1-2-4	Supply L1	
1-2-5	Supply L2	
1-2-6	Supply L3	
1-2-16	Supply f	
2	**Monitor 2**	
2-1	SW version	
3	**Load setup**	
3-2-1	Load 1	
3-2-2	Mhs1	
3-2-3	Mhf1	
3-2-4	Mls1	
3-2-5	Mlf1	
3-2-6	Load 2	
3-2-7	Mhs2	
3-2-8	Mhf2	
3-2-9	Mls2	
3-2-10	Mlf2	
3-4-1	Load 1	
3-4-2	Input 1	
3-4-3	Load 2	
3-4-4	Input 2	

Param.	Name	Value
4	**Start-up**	
4-1-1	MFI1 oper.	
4-1-2	MFI1 IntL	
4-1-3	MFI1 2OLL	
4-1-4	MFI1 CintL	
4-2-1	MFI2 oper.	
4-2-2	MFI2 IntL	
4-2-3	1+2 IntL	
4-2-4	MFI2 2OLL	
4-2-5	MFI2 CintL	
4-2-6	1+2 CintL	
4-3-1	ROUT oper.	
4-3-2	ROUT logic	
4-3-3	ROUT LoadX	
4-3-4	TempX meas	
4-3-5	TempX lim	
4-4-1	T1 operat.	
4-5-1	T2 operat.	
4-6-1	AOUT oper.	
4-6-2	Zero load	
4-6-3	Nom. Load	
4-7-1	Load meas.	
4-7-2	Load rate%	
4-7-13	Acc-t slow	
4-7-14	Acc-t fast	
4-8	Hoist ctrl	
4-9-1	SR select	
4-9-2	Load limit	
4-10-1	OT run ?	
4-10-2	OT limit	
4-10-3	Supply sup	
4-11-1	Hoist cnt	
4-11-2	Run sup.	
4-11-3	B OL	
4-11-4	B nom load	

☞ The hoist-monitoring unit has been tested and proven fully functional.

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10Overload protection – Load sensor

10.1 Load sensor-system

The load sensor-system uses the analogue signal coming from a load sensor. The sensor can be either a Strain-gauge type, or a Hall-sensor type.

The Strain-gauge type of sensor is the default solution in hoists. The Strain-gauge type will give out a signal in the range of 0…40mVDC. To amplify this signal, a load sensor amplifier must be connected between the sensor and the hoist-monitoring unit. The instructions on how to set up the amplifier are included in chapter ***"Load sensor adjustment"*** of this manual.

The Hall-sensor type was commonly used in XL-hoists. The Hall sensor gives out a signal in the range of 4…6VDC, which can be fed directly into the hoist-monitoring unit.

☞ Other sensor types are possible to use if the load sensor gives out a signal in the range of 0V to 8V.

10.1.1 Load sensor set-up

Follow the instructions given in the section ***"Load sensor adjustment"*** of this manual.

10.2 Load sensor parameters

Parameter	Value	Description	Note
4-7 Load param		**Load calculation menu**	**Accessible with password 4: 8124**
4-7-1 Load meas.	Sens.	Selects the load sensor measurement method	

Parameter	Value	Description	Note
6 Design		**In this menu are the mechanical design values of the hoist determined.**	**Accessible with password 6: 9822**
6-4 Nom. Load	0.00- 999t	Rated load of the hoist.	Setting according to the data label of the hoist

In case the automatic load calibration sequence does not give the required results (i.e. the difference between the actual load and the calculated/displayed load is more than 10%), the unit can be calibrated manually with the following parameters. Refer to paragraph ***"Manual load calibration"*** of this chapter for further instructions.

Parameter	Value	Description	Note
3-4 SC values		**Load calibration values for the load sensor method**	**Accessible with password 2: 0732**
3-4-1 Load 1	25.0t	The higher test load value (80% – 130%) × Hoist nominal Load [tons]	
3-4-2 Input 1	7.23V	The load measurement voltage in the analogue input Ain1 corresponding to the test load	
3-4-3 Load 2	0.00t	The lower test load value, usually the empty hook 0.00t (0% – 30%) × Hoist nominal Load [tons]	
3-4-4 Input 3	2.07V	The load measurement voltage in the analogue input Ain1 corresponding to the load 2	

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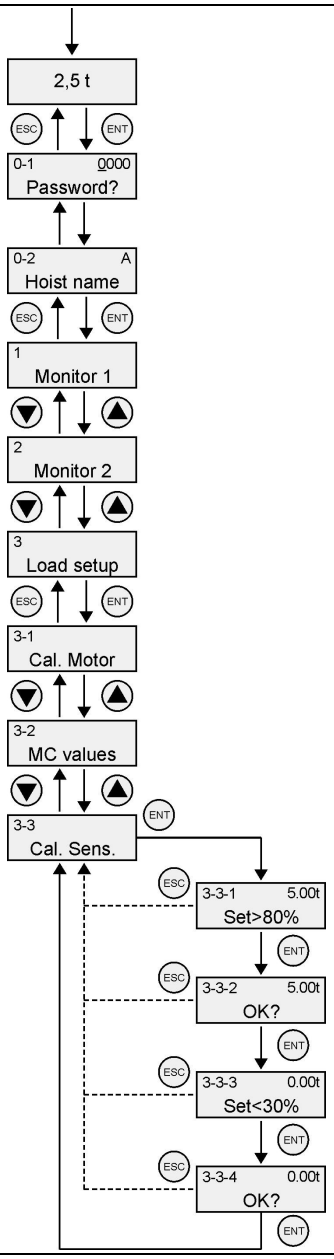
10.3 Load calibration sequence with load sensor

Before carrying out the calibration procedure, make sure that the load sensor amplifier (if present) is correctly installed and calibrated. Refer to the chapter "Load sensor adjustment" of this manual for instructions.



Power On

Enter password 0732. Display will jump to menu 3 parameters when one hoist is being calibrated.

If there is more than one Hoist (Multi hoisting mode) then the hoist must be selected by a "Letter" Name. .

Go to menu 3-3-1.

Hang a higher test-load of 80…130% of the rated load of the hoist in the hook and make sure the load hangs freely and steady. Enter the value of the test load (in tons). Confirm the correct value with the ENT button and wait until the next text appears.
Hang a lower test-load of less than 30% of the rated load of the hoist in the hook. Typically this is an empty hook. Make sure the load hangs freely and steady. Enter the value of the test load (in tons, empty hook = "0.00t").
Confirm the correct value with the ENT button. The display shifts automatically back to "Cal. Sens." when the values are accepted.

Run the calibration sequence according to the display instruction.

When the calibration is done, write down the load setup values of parameters 3-4-1, 3-4-2, 3-4-3 and 3-4-4 in the commissioning table.

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10.4 Manual load calibration

Before starting the calibration, make sure you have a known test-load available of at least 80% and maximum 130% of the nominal lifting capacity of the hoist

It is advisable to by-pass the overload protection during this calibration routine by setting the parameter

3-5 “OL protect” = OFF

The overload protection will automatically reset after 30 min. or after power off.

- Lift the test load up until it hangs freely and steady.
- Select parameter 3-4-1 “Load 1” and enter here the value of the test load (in tons)
- Select parameter 1-2-10 “Ain1 value” and read the value
- Select parameter 3-4-2 “Input 1” and enter here the value of parameter 1-2-10
- Select parameter 1-2-1 “Act. Load”. The display should show “nnn”t (where “nnn” is the value of your test load), ±5%. Repeat steps 1 to 4 until the value is within the desired range.
- Lower the load and ensure the hook is empty
- Select parameter 3-4-3 “Load 2” and enter here 0.00t
- Select parameter 1-2-10 “Ain1 value” and read the value
- Select parameter 3-4-4 “Input 2” and enter here the value of parameter 1-2-10
- Select parameter 1-2-1 “Act. Load”. The display should show 0.00t, ±5%. Repeat steps 5 to 8 until the value is within the desired range.

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11Overload protection – Motor torque

11.1 Overload protection instructions

11.1.1 Motor torque calculation-system

The parameters as described in the table ***"Motor torque calculation parameters"*** must be checked and if needed adjusted, before the calibration sequence is carried out. The unit used these values in order to calculate the actual load. After the calibration has been done, it is recommended to write down the values of the parameters of group ***"3-2 MC values"*** and ***"4-7 Load param"***.

11.1.2 Motor torque calculation parameters

Parameter	Value	Description	Note
4 Start-up		**Start-up menu**	**Accessible with password 4: 8124**
4-4 T1		T1 parameters	
4-4-1 T1 operat.	B NTC	Determines the type of thermistors in the low speed windings, connected to the temperature 1 input	Type "B" is presently used as standard
4-5 T2		**T2 parameters**	**Accessible with password 4: 8124**
4-5-1 T2 operat.	B NTC	Determines the type of thermistors in the fast speed windings, connected to the temperature 2 input	Type "B" is presently used as standard

Parameter	Value	Description	Note
4-7 Load param		**Load calculation menu**	**Accessible with password 4: 8124**
4-7-1 Load meas.	Motor	Selects the motor torque calculation method	
4-7-2 Load rate%	10	Load increase rate for controlling the hoisting in two step control, speed change to fast speed is allowed when actual load change within 200ms < parameter 4-7-2.	See also description in chapter ***"Sudden load increase supervision"*** of this manual for further details
4-7-3 R0_F	0.00 – 1000	Resistance of the fast speed windings at temperature T0	If accurate measurements can not be performed, one has to rely on the information given in the motor data files.
4-7-4 R0_S	0.00 – 1000	Resistance of the slow speed windings at temperature T0	If accurate measurements can not be performed, one has to rely on the information given in the motor data files.
4-7-5 T0	"nn" C	Temperature T0 "nn" at the time when measurement is carried out, in degrees Celsius	If accurate measurements can not be performed, one has to rely on the information given in the motor data files.
4-7-6 Temp_slow	T1	Temperature measurement channel for the motor slow speed windings	
4-7-7 Temp fast	T2	Temperature measurement channel for the motor fast speed windings	
4-7-8 C2F	143	Coefficient 2 for fast speed	Additional motor losses in fast speed windings. Setting is motor dependent
4-7-9 C2S	236	Coefficient 2 for slow speed	Additional motor losses in slow speed windings. Setting is motor dependent
4-7-10 C1F	165	Coefficient 1 for fast speed	Iron losses in fast speed windings. Setting is motor dependent
4-7-11 C1S	255	Coefficient 1 for slow speed	Iron losses in slow speed windings. Setting is motor dependent
4-7-12 ki	0.0 - 300.0	Reduction factor for current transformer [A/V]	See appendix 3 ***"Current Transformer Table"*** of this manual for the correct setting

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Parameter	Value	Description	Note
4-7-13 Acc-t slow	0.20s	Acceleration time from stop to slow speed 0.00s – 1.00s	See also chapter ***"Starting and stopping through slow speed"*** of this manual
4-7-14 Acc-t fast	0.30s	Acceleration time from slow speed to fast speed 0.00s – 1.00s	See also chapter ***"Starting and stopping through slow speed"*** of this manual

Parameter	Value	Description	Note
6 Design		**In this menu are the mechanical design values of the hoist determined.**	**Accessible with password 6: 9822**
6-4 Nom. Load	0.00- 999t	Rated load of the hoist.	Setting according to the data label of the hoist

In case the automatic load calibration sequence does not give the required result (i.e. the difference between the actual load and the calculated/displayed load is more than 10%), the unit can be calibrated manually with the following parameters. Refer to paragraph ***"Manual load calibration"*** of this chapter for further instructions.

Parameter	Value	Description	Note
3-2 MC values		**Load calibration value for the motor torque method**	**Accessible with password 2: 0732**
3-2-1 Load 1	0.00- 999t	The higher test load value (80% – 130%) × Hoist nominal Load [tons]	
3-2-2 Mhs1	"nn.nn"	Motor torque for hoisting with slow speed (test load)	The value "n" depends on the motor type. The calibration procedure will automatically write the correct value.
3-2-3 Mhf1	"nn.nn"	Motor torque for hoisting with fast speed (test load)	The value "n" depends on the motor type. The calibration procedure will automatically write the correct value.
3-2-4 Mls1	"-nn.nn"	Motor torque for lowering with slow speed (test load)	The value "n" depends on the motor type. The calibration procedure will automatically write the correct value.
3-2-5 Mlf1	"-nn.nn	Motor torque for lowering with fast speed (test load)	The value "n" depends on the motor type. The calibration procedure will automatically write the correct value.
3-2-6 Load 2	0.00t	The lower test load value, usually the empty hook (0.00t).	A load in the range of 0…30% × hoist nominal load can be used
3-2-7 Mhs2	"nn.nn"	Motor torque for hoisting with slow speed (load 2)	The value "n" depends on the motor type. The calibration procedure will automatically write the correct value.
3-2-8 Mhf2	"nn.nn"	Motor torque for hoisting with fast speed (load 2)	The value "n" depends on the motor type. The calibration procedure will automatically write the correct value.
3-2-9 Mls2	"-nn.nn	Motor torque for lowering with slow speed (load 2)	The value "n" depends on the motor type. The calibration procedure will automatically write the correct value.
3-2-10 Mlf2	"-nn.nn	Motor torque for lowering with fast speed (load 2)	The value "n" depends on the motor type. The calibration procedure will automatically write the correct value.

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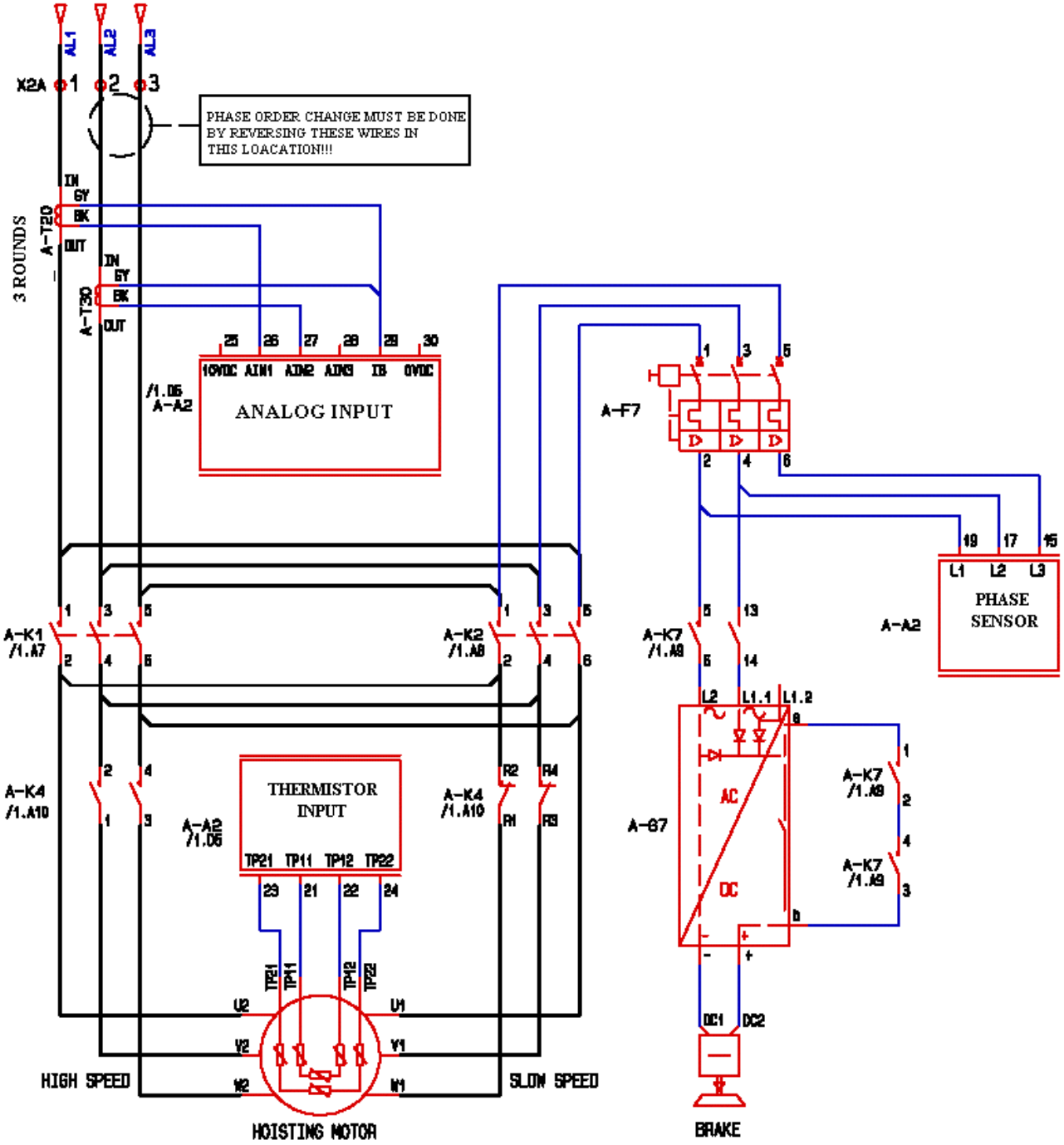
11.2 Connections



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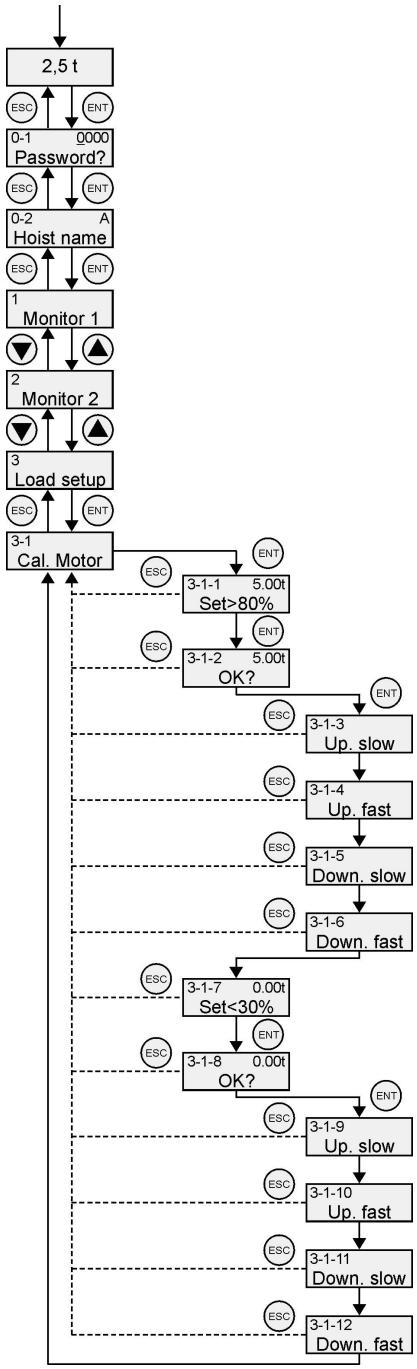
11.3 Load calibration sequence with motor torque



Power On

Enter password 0732. Display will jump to menu 3 parameters when one hoist is being calibrated.

If there is more than one Hoist (Multi hoisting mode) then the hoist must be selected by a “Letter” Name. .
Go to menu 3-1-1.

Hang a higher test-load of 80…130% of the rated load of the hoist in the hook and make sure the load hangs freely and steady. Enter the value of the test load (in tons).

Confirm the correct value with the ENT button.

The text “Up. Slow” appears on the display. Drive the hoist in slow speed upwards until the next text appears
Drive the hoist in fast speed upwards until the next text appears.

Drive the hoist in slow speed downwards until the next text appears
Drive the hoist in fast speed downwards until the next text appears.
Hang a lower test-load of less than 30% of the rated load of the hoist in the hook. Typically this is an empty hook. Make sure the load hangs freely and steady. Enter the value of the test load (in tons, empty hook = “0.00t”).
Confirm the correct value with the ENT button.

The text “Up. Slow” appears on the display. Drive the hoist in slow speed upwards until the next text appears
Drive the hoist in fast speed upwards until the next text appears.

Drive the hoist in slow speed downwards until the next text appears
Drive the hoist in fast speed downwards until the next text appears.

Run the calibration sequence according to the display instruction.

When the calibration is done, write down the load setup values of parameter group 3-2 in the commissioning table.

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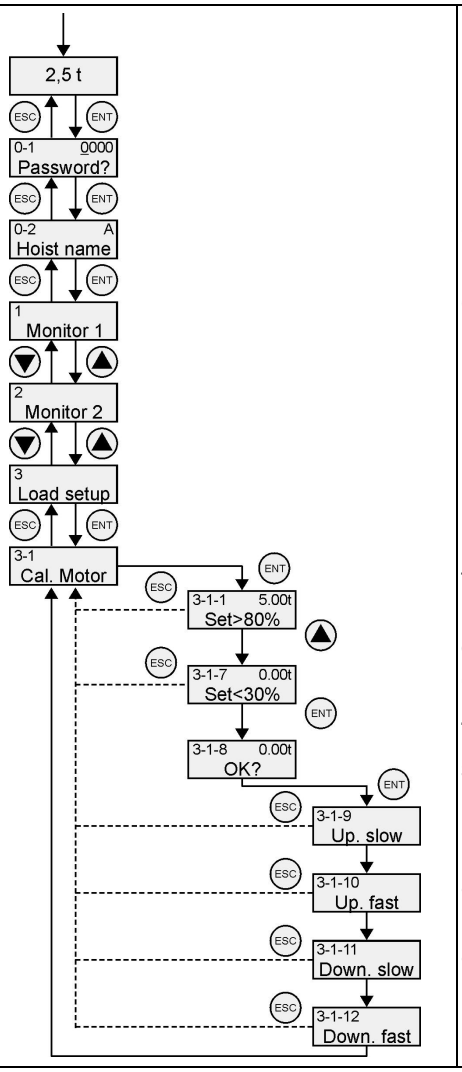
11.4 Zero load calibration sequence with motor toque



Power On

Enter password 0732.

Select the hoist.

Go to menu 3-1-1.

Move to the next section with the arrow up button.
Hang a test-load of less than 30% of the rated load of the hoist in the hook. Typically this is an empty hook. Make sure the load hangs freely and steady. Enter the value of the test load (in tons, empty hook = “0.00t”).
Confirm the correct value with the ENT button.

The text “Up. Slow” appears on the display. Drive the hoist in slow speed upwards until the next text appears
Drive the hoist in fast speed upwards until the next text appears.

Drive the hoist in slow speed downwards until the next text appears
Drive the hoist in fast speed downwards until the next text appears.

Run the calibration sequence according to the display instruction.

When the calibration is done, write down the load setup values of parameter group 3-2 in the commissioning table.

11.5 Manual load calibration

Before starting the calibration, make sure you have a known test-load available of at least 80% and maximum 130% of the nominal lifting capacity of the hoist

It is advisable to by-pass the overload protection during this calibration routine by setting the parameter

3-5 “OL protect” = OFF

The overload protection will automatically reset after 30 min. or after power off.

If the display shows more than the lifted load, continue with A.

If the display shows less than the lifted load, continue with B.

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A. The display shows more than the lifted test load:

- Increase (more positive) the value of parameter *3-2-2 "Mhs1"*
- Select parameter *1-2-1 "Act. Load"*.
- Drive the hoist in slow speed up and check the load from the display.
- Repeat step 1…3 until the display shows the correct load.
- Increase (more positive) the value of parameter *3-2-3 "Mhf1"*
- Select parameter *1-2-1 "Act. Load"*.
- Drive the hoist in fast speed up and check the load from the display.
- Repeat step 5…7 until the display shows the correct load.
- Decrease (more negative) the value of parameter *3-2-4 "Mls1"*
- Select parameter *1-2-1 "Act. Load"*.
- Drive the hoist in slow speed down and check the load from the display.
- Repeat step 9…11 until the display shows the correct load.
- Decrease (more negative) the value of parameter *3-2-5 "Mlf1"*
- Select parameter *1-2-1 "Act. Load"*.
- Drive the hoist in fast speed down and check the load from the display.
- Repeat step 13…15 until the display shows the correct load.

B. The display shows less than the lifted test load:

- Decrease (less positive) the value of parameter *3-2-2 "Mhs1"*
- Select parameter *1-2-1 "Act. Load"*.
- Drive the hoist in slow speed up and check the load from the display.
- Repeat step 1…3 until the display shows the correct load.
- Decrease (less positive) the value of parameter *3-2-3 "Mhf1"*
- Select parameter *1-2-1 "Act. Load"*.
- Drive the hoist in fast speed up and check the load from the display.
- Repeat step 5…7 until the display shows the correct load.
- Increase (less negative) the value of parameter *3-2-4 "Mls1"*
- Select parameter *1-2-1 "Act. Load"*.
- Drive the hoist in slow speed down and check the load from the display.
- Repeat step 9…11 until the display shows the correct load.
- Increase (less negative) the value of parameter *3-2-5 "Mlf1"*
- Select parameter *1-2-1 "Act. Load"*.
- Drive the hoist in fast speed down and check the load from the display.
- Repeat step 13…15 until the display shows the correct load.

It is difficult to predict how much one should increase or decrease the values. The best way to do this is just by trying out (say steps of 10% of the original value)

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12Load sensor adjustment

12.1 KAE400 + Strain Gauge

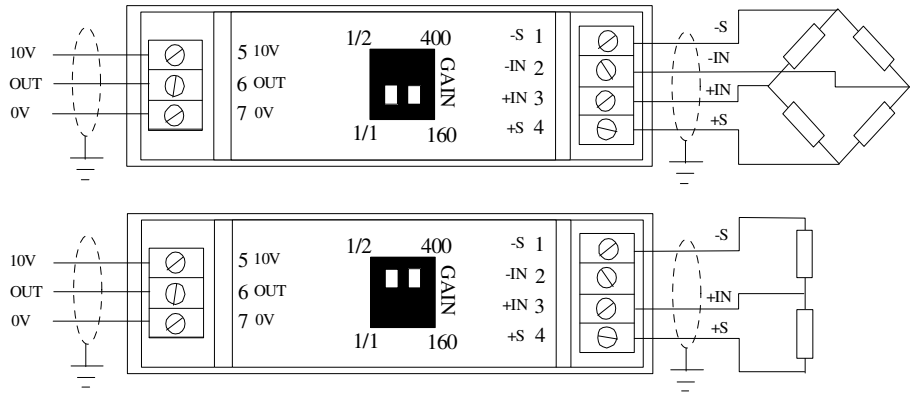
12.1.1 General

KAE400 is a amplifier which is used to amplify the strain gauge load sensor signal (mV) to higher level (V). Both full bridge and half bridge sensors can be connected. Amplifier has zero adjustment with led indication and two-fixed gain (160/400).

12.1.2 Technical data

Operation voltage (Vsup)	9,5...12 VDC (maximum ratings)
Sensor supply voltage (Vssup)	Vsup-0,5 VDC
Gain (set by a switch)	160 / 400
Zero adjustment	-10…+10 mV (350R measuring elements) -30...+30 mV (1k measuring elements)
Output voltage at 0 mV input	2,048 VDC
Minimum output load	10 kohm
Operation temperature	-25…+85° C
Wire brakage monitoring	OUT: < 0,5VDC or > 8,0 VDC
EMC standards	EN61000-6-2 , EN61000-6-3

12.1.3 Wiring



In the cable of a half bridge sensor there is three wires and a in the cable of a full bridge sensor is four wires.

Terminal	Signal	Device
1	-S	Sensor
2	-IN	Sensor (Free*)
3	+IN	Sensor
4	+S	Sensor
5	10 VDC	Terminal 25
6	SIGN	Terminal 26
7	0 VDC	Terminal 30

* In the half bridge sensor

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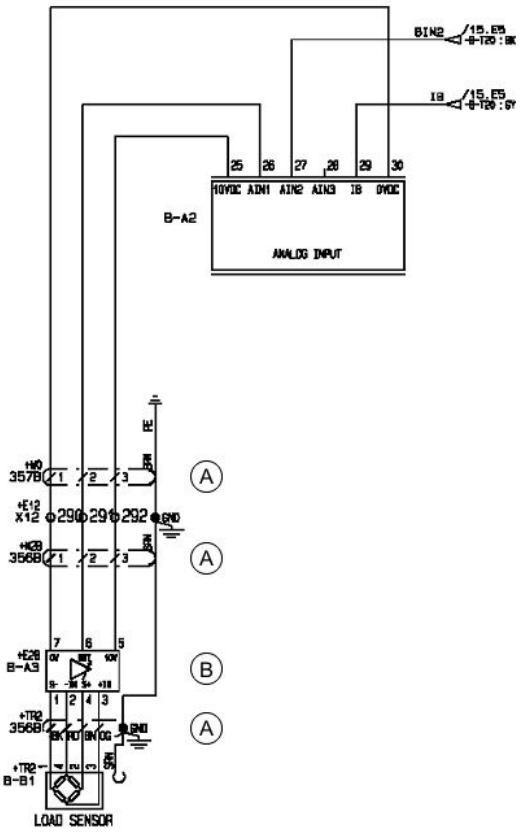

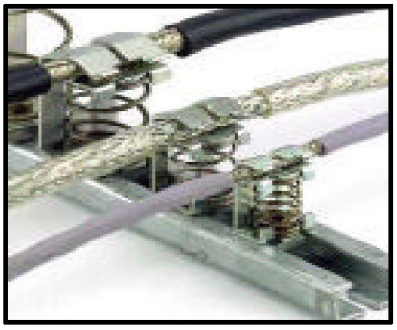

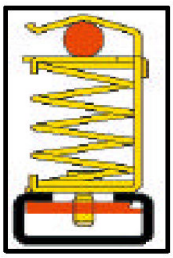

A. Shield is grounded with 360 degree connector
B. Amplifier KAE400

12.1.4 Adjustment

Tools needed for adjustment:

- A small screwdriver for trimmers
- Test load

Adjustment can be done with a known load in the range of 80…130% of the rated lifting capacity.

Following procedure can be used to perform the setup of the amplifier:

- Connect the sensor and monitoring unit. In a case of half bridge sensor the signal is connected to +IN-terminal. Connect the cable shields outside of the amplifier to 360° terminals.
- Select the sensor type, full bridge (1/1) or half bridge (1/2) by the dipswitch.
- Set the gain to 400 by the dipswitch
- Switch the power on
- If amplifier and monitoring unit are near each other, go to the monitoring unit parameter 1-2-10 Ain 1. The parameter 1-2-10 shows amplifiers output signal level. If the monitoring unit's display can't be read a multimeter is needed. Measure voltage level between KAE400's terminal 6 and 7.
- Set the zero at no load by turning the trimmer until the led lits and then slightly back that the led does not lit anymore. Led lits when the output is below 2,1VDC.
- Check the gain at higher nominal load. If the output is over 6,5VDC set the gain to 160 by the dipswitch. If the output is under 2,0VDC exchange the wires –S and +S, and return back to section 5.
- Perform the calibration of the monitoring unit at nominal load and at no load

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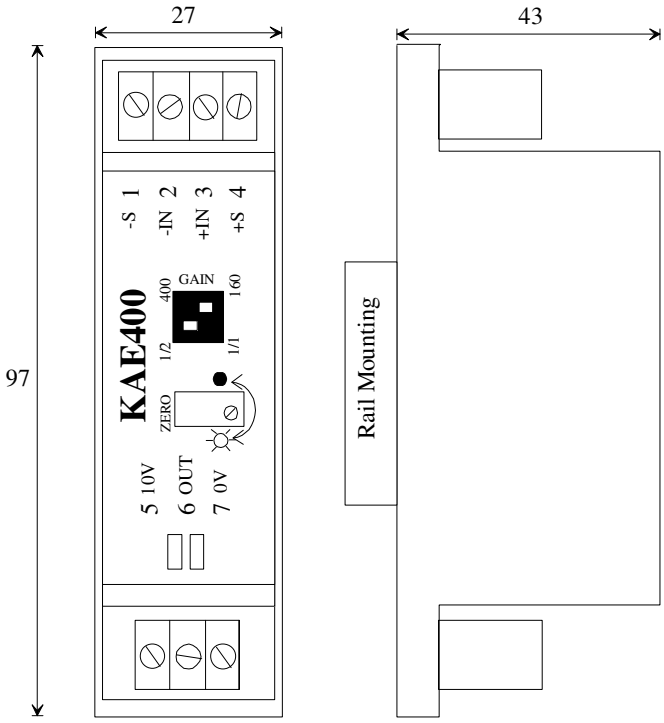
12.1.5 Dimensions



12.2 ESD142 amplifier + Strain Gauge

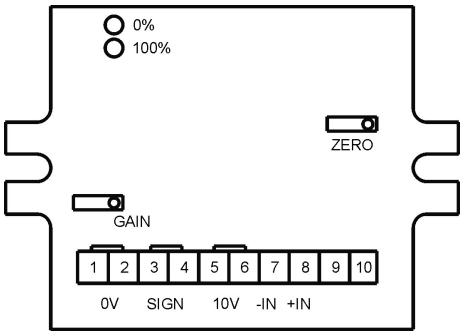
12.2.1 ESD142 Description

The ESD142 is a load sensor amplifier, which is used to amplify the load signal coming from a strain-gauge type of load sensor to a suitable voltage level for the hoist-monitoring unit.

At the moment there are two versions, the **ESD 142** and the **ESD142/1**. The basic model is the ESD 142, which is used with full-bridge load sensors. The ESD 142/1 is the modified version, which is suitable for half-bridge load sensors.

The units are adjusted by means of two trimmers, named **"ZERO"** and **"GAIN"**. With the ZERO-trimmer, the 0% load adjustment is biased. The GAIN-trimmer is used to adjust the amplification factor in order to reach the required output voltage at full load.

There are two LED's, marked as "**0%"** and "**100%"**, indicating the status of the load.



Terminal	Signal	Device
1	0 VDC	Terminal 30
2	0 VDC	Sensor
3	Signal	Terminal 26
4	Signal	free
5	10 VDC	Terminal 25
6	10 VDC	Sensor
7	- IN	Sensor
8	+ IN	Sensor
9	SHLD	screen
10	4 VDC	free

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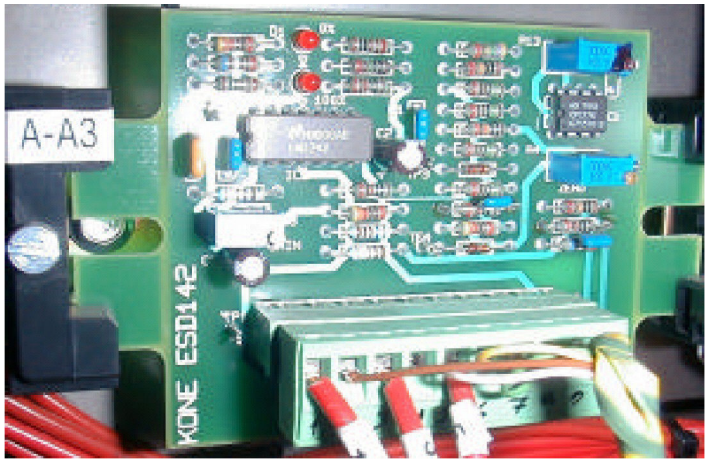

12.2.2 Adjustment

Tools needed for adjustment:

- A small screwdriver for trimmers
- Test load

Adjustment can be done with either a test load of exactly 100% of the rated load of the hoist, or with a known load in the range of 80…130% of the rated lifting capacity.

The adjustment is carried out in two steps:

- Zero load adjustment
- “Known load” adjustment

12.2.3 Zero load adjustment

Adjustment is done with trimmer “ZERO”

- Verify that there is no load in the hook
- Check the LED “0%”
- If the LED 0% is ON, turn the trimmer counter-clockwise until the LED just goes off
- If the LED 0% is OFF, turn the trimmer clockwise until the LED lights up, then counter-clockwise until the LED just goes off.
- The output voltage (measured between terminal 1 and 3) should be about 4 VDC (+/- 0.5 VDC)

12.2.4 Adjustment with higher load

Adjustment is done with trimmer “GAIN”

- Lift the higher load and wait until the load hangs steady and does not swing
- Check the LED “100%”
- If the LED “100%” is ON, turn the trimmer clockwise until the LED just goes off
- If the LED is OFF, turn the trimmer counter-clockwise until the LED lights up, then clockwise until the LED just goes off.
- The output voltage (measured between terminal 1 and 3) should be about 6 VDC (+/- 0.5 VDC)
- Lower the load and verify that the “0%” LED remains OFF
- Lift the load again and verify that the “100%” LED remains OFF

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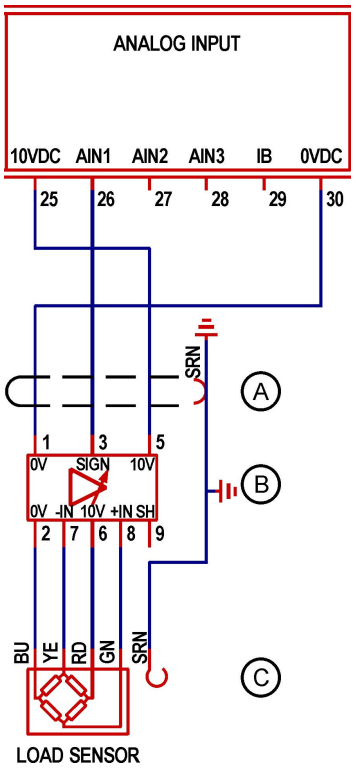
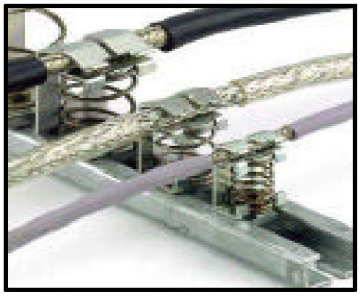
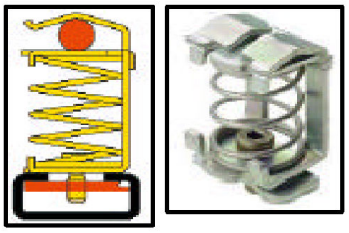
12.2.5 Connections

Long cables







A. Shield is grounded with 360 degree connector
B. Full bridge amplifier ESD142
C. Shield end connection in Strain gauge load sensor cable in floating

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13Faults and warnings

13.1 Faults

Fault means that the hoist control unit has detected a situation that prevents the hoist from running. The hoist control unit stops the motion, indicates the fault text on the display and illuminates the red LED continuously on both the unit and display. Depending on the detected situation and parameter settings, only hoisting or only lowering is allowed, or running the hoist is totally prevented by the hoist-monitoring unit.

The fault messages shown on the display are given in the table below. The messages appear when the corresponding fault is detected. The message disappears automatically when the corresponding fault situation is cleared. Also it is possible to clear the message and return to the original display by pushing the ENT–button. However, as long as the fault is active, the red LEDs are illuminated and the fault message can be read from the status mode.

13.1.1 Fault codes and description

Fault name	**Code (Fault Logger)**	**Description**	**Running**
Hoist OL	F_OL	Hoist overload	Hoisting prevented, lowering allowed
Motor OT	F_OT	Hoist motor overtemperature	Hoisting (and lowering) prevented
Int. relay	F_SR	A fault detected in the internal safety relay	Running prevented
RUN act.	F_Run	A fault detected in controlling the direction outputs, only in two-step control	Running prevented
Run FB	– *)	The hoist stops although the unit controls it to run	Controls to stop, new start possible
Brake	F_Br	Hoist brake does not open, only in motor based load calculation	Lowering prevented
Br wear	F_Brw	Hoist brake worn-out, only when the sensor applied	Hoisting (and lowering) prevented
Sensor ch.	F_SCh	Measurement signal out of acceptable range	Hoisting prevented
Curr.meas.	F_Ain	Measurement signal out of acceptable range	Hoisting prevented
Supply vol	F_SPh	Main supply fault, one phase missing, only when main supply measured	Running prevented
Phaseorder	F_Sor	Main supply fault, incorrect phase order, only when main supply measured	Running prevented
Mparameter	F_MP	Internal parameter reading or writing fault	Running prevented
Cparameter	F_CP	Internal parameter reading or writing fault	Running prevented
CAN bus	F_CAN	CAN bus communication fault, only in multi hoisting	Running prevented
Bridge OL	F_BOL	Overload in calculated bridge load, only in multi hoisting	Hoisting prevented, lowering allowed
Bridge RS	F_BRS	Fault in multi hoisting, requests for running or stopping not simultaneous	Running stopped, new start possible
Slack Rope	– *)	Slack rope function is active	Lowering prevented
No Signal	– *)	Communication fault between unit and display or Internal processor fault	Running possible Running prevented

☞ – *)These faults are not collected into the fault logger (parameter 5-2)

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13.2 Warnings

13.2.1 General warnings

The warning state means that at least one calculated condition monitoring value has exceeded the corresponding design value of the hoist. Any active warnings are indicated with the corresponding text on the display. The warning text appears on the display directly when the value exceeds the design value, and each time after switching the power on to the hoist control unit, until the warning is cleared. Moving to the load status display is carried out with the arrow buttons of the display. In addition, the LEDs in the unit and display are blinking.

Warning name	Description
SWP%	The calculated relative safe working period SWP% is less than zero
Starts	The actual number of hoist starts has exceeded the design limit
Run time	The actual value for the hoist run time has exceeded the design value
Br SWP%	The calculated value for the brake SWP% is less than zero
E-stops	The number of interrupted hoists has exceeded the design limit
Control	The number of actual control actions has exceeded the design limit
ST MFI1 *1)	The starts counter for MFI1 has exceeded the given maximum value
RT MFI1 *1)	The run time counter for MFI1 has exceeded the given maximum value
ST MFI2 *1)	The starts counter for MFI2 has exceeded the given maximum value
RT MFI2 *1)	The run time counter for MFI2 has exceeded the given maximum value

☞ If any warning is active, the hoist will still run normal, but safe using is not guaranteed.

☞ *1) When the programmable inputs MFI1 and MFI2 are used as start and run time counters, the corresponding operation must be selected with the parameters. Otherwise the starts and the run time values are not counted and the warnings related to MFI1 and MFI2 do not activate.

☞ When warning has activated check actions from the Hoist's GO – manual or ask from crane factory.

13.2.2 Service warnings

Service warning state is activated when at least one of the monitored items has exceeded the limit set by parameter group 5. Service warning status is indicated with the corresponding text on the display. The service warning text appears on the display directly when the service warning state becomes active, and each time after switching the power on to the hoist control unit, until the warning is cleared. Moving to the load status display is carried out with the arrow buttons of the display. In addition, the LEDs in the unit and display are blinking. If any service warning is active, the hoist can still be run normally.

Name	Description
Run time	The actual value for run time has exceeded the set service limit value
Starts	The actual value for the start counter has exceeded the set service limit value
SWP%	The actual value of SWP% is less that the set service limit for SWP%
Br SWP%	The calculated brake SWP% value is less than the set service limit value

☞ When service warning has activated ask actions from crane service company

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14Troubleshooting

In the fault logger (5-2 Fault log) each fault is identified with a fault code and the values of the start counter that corresponds to the detection time of the fault. The first fault in the logger (5-2-1) is the latest one.

In the table below, the column “Code” (e.g. F_OL) indicates the abbreviation for each fault as shown in the fault logger.

14.1 Fault descriptions

14.1.1 Fault Hoist OL F_OL

Hoist overload

- Confirm that the value on load display is the actual load, not tared load
- Confirm that the lifted load is not more than 110% of the rated load of the hoist.
- Load display updates the values slower than overload protection trips.
- Check the parameter 6-4 (must be equal to the rated load of the hoist)
- Check if intermediate load limits are in use. (Parameters 4-1-1 and 4-2-1)
- Perform the calibration procedure, when required, as described in this manual.
- Check the parameter 4-7-1 value

The parameter 4-7-1 value is “Sens.”

- Check the parameters 3-4-2 “Input 1” and 3-4-4 “Input 2”. When the values are equal to each other, the calibration is done with only one load. Perform the calibration procedure as described in this manual.
- Check that the parameter 1-2-10 Ain1 value is between the parameters 3-4-2 and 3-4-4 value
  - If the parameter 1-2-10 value is ~9.8V
    - The signal wire hasn’t been connected to the Analog input 1 (the terminal 26)
    - The neutral wire is broken between the unit and the sensor.
    - Check the connections between the amplifier and strain gauge.
  - If the parameter 1-2-10 value is less than ~1V
    - The power signal wire (+10V) is broken between the unit and the sensor.
    - The strain gauge sensor is not connected to the amplifier.
    - Check the connections between the amplifier and strain gauge.
  - If the parameter 1-2-10 value is OK, but the load measure don’t work, then is possible that wires have been connected crosswise.
    - Check the connections from the unit to the load sensor.

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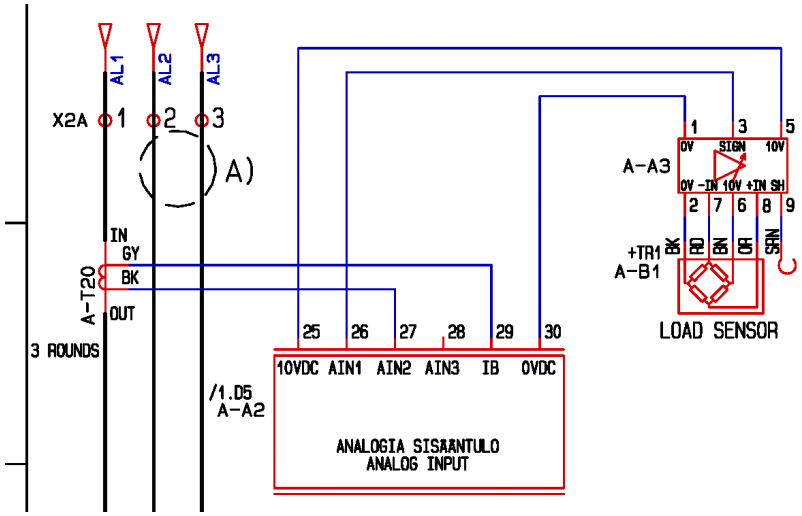

The parameter 4-7-1 value is "Motor"

- Check parameters 1-2-2 and 1-2-3.
  - If the temperature sensors are not connected, the values for parameters 1-2-2 "Temp 1" and/or 1-2-3 "Temp 2" is < -20 °C (< 0 °F).
- Check that temperature sensor 1 (slow speed) is connected to terminals 21 - 22, and sensor 2 (fast speed) is connected to terminal 23 - 24.
  - Drive the hoist in slow speed and check that reading of parameter 1-2-2 Temp 1 increase.
  - Drive the hoist in fast speed and check that reading of parameter 1-2-3 Temp 2 increase.
- Check the parameters 3-2-2 "Mhs1" and 3-2-7 "Mhs2".
  - If the values are equal to each other, the calibration is done with only one load. (Confirm by checking the following parameters: 3-2-3≠3-2-8, 3-2-4≠3-2-9, 3-2-5≠3-2-10).
  - Perform the calibration procedure as described in this manual.
- If the parameters 3-2-7 … 3-2-10 values are negative, check the current transformers and their connections and/or the voltage measurement connections. Pay special attention to the correct phase order.
- If supply voltage frequency is 60Hz, check that parameter 1-2-16 is set to 60 Hz. The hoist-monitoring unit must identify the supply voltage frequency.
- See chapter *"Overload protection – Motor torque"* of this manual

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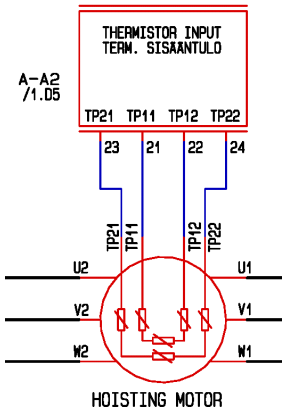
14.1.2 Fault Motor OT F_OT

Hoist motor overtemperature

- Check that 4-4-1 T1 operat. corresponds to the actual sensor of the hoist motor
- Check that 4-5-1 T2 operat. corresponds to the actual sensor of the hoist motor
- When NTC-type sensor is selected, check parameter 4-10-2 “OT limit”
- Lowering can be allowed by setting 4-10-1 “OT run ?” = Down
- Unplug the terminal X2 and measure the temperature sensor’s resistance between terminal 21 and 22 also between terminal 23 and 24.
  - PTC-sensor or bimetal switch: the resistance should be less than 1kohm
  - NTC sensor: The resistance should be between 0.5kohm and 100 kohm. See Appendix 4 “Motor temperature NTC-charts”
- Measure the internal resistance of temperature input’s from terminal’s pins by multimeter (disconnect the orange terminal X2)
  - When input is okay the input’s internal resistance is ~6.3 kohm.



14.1.3 Fault Int. relay F_SR

A fault detected in the internal safety relay

- Internal hardware fault in the unit, internal safety relay contact closed all the time.
- Contact the manufacturer.

14.1.4 Fault RUN act. F_Run

A fault detected in controlling the direction outputs (only two step control)

- Feedback is ON already before the direction control (HOUT, LOUT) is activated.
- Check the connections and wiring of terminals 1 to 19.
  - Especially for short circuits between HIN - HOUT and LIN - LOUT.
- If external connections are correct and the fault occurs only in starts upwards, the internal upwards control relay may be malfunctioning
- If external connections are correct and the fault occurs only in starts downwards, the internal downwards control relay may be malfunctioning
- Make sure that the current transformer is correctly connected to the terminal 27 (I2-A)
- Check that the current transformer operates correctly

Make sure that any other electrical loads (e.g. fans, inverters) haven’t been connected behind the current transformer.

14.1.5 Fault Run FB– (2)

The hoist stops although the unit controls it to run

- Check AIN-2 values by parameter 1-2-11
  - Normal values ~5V
  - If ~9.8V check current transformer connection
- Check function of contactors
  - If the contactor is energized the problem is in the power line connections or the current transformer connections, probably
    - Check the current transformer connection to the terminal 27 (I2-A)
    - Check the power line connections to the hoisting motor

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- If the contactor isn't energized then problem is the control connections. Check connections between the contactors and the unit terminal 1
  - Limit switches
  - Bimetal switch
  - Mechanical overload switch
- Check the operation of the current transformer
  - Drive the hoist in slow speed and measure voltage between the terminal 27 and the terminal 29
  - See appendix: Current Transformer Table
- Check connection to the hoist motor
  - If the power line is broken then current can't go to the motor
- If the hoist is stopped by any external reason (for example stop limit switch, breaker fault) the unit always indicates this fault. The situation is resetted when the requests (HIN and LIN) are deactivated.

Stepless control

- Check that the brake contactor switch is connected to the terminal 8 (FIN)
- Check that there are not faults of the inverters.
- If the hoist is stopped by any external reason (for example stop limit switch, breaker fault, inverter fault) the unit always indicates this fault. The situation is resetted when the requests (HIN and LIN) are deactivated.

14.1.6 Fault Brake F_Br

Hoist brake does not open (only in motor torque based load calculation. The parameter 4-7-1 "Load meas." = Motor)

- Check that the hoist brake opens properly
- Check the brake connections
- Check parameters 1-2-2 and 1-2-3.
  - If the temperature sensors are not connected, the values for parameters 1-2-2 "Temp 1" and/or 1-2-3 "Temp 2" is < -20 ^{o}C (< 0 ^{o}F).
- Check that temperature sensor 1 (slow speed) is connected to terminals 21 - 22, and sensor 2 (fast speed) is connected to terminal 23 - 24.
  - Drive the hoist in slow speed and check that reading of parameter 1-2-2 Temp 1 increase.
  - Drive the hoist in fast speed and check that reading of parameter 1-2-3 Temp 2 increase.
- Check the parameters 3-2-2 "Mhs1" and 3-2-7 "Mhs2".
  - If the values are equal to each other, the calibration is done with only one load. (Confirm by checking the following parameters: 3-2-3≠3-2-8, 3-2-4≠3-2-9, 3-2-5≠3-2-10).
  - Perform the calibration procedure as described in this manual.
- If the parameters 3-2-7 … 3-2-10 values have the negative, check the current transformers and their connections and/or the voltage measurement connections. Pay special attention to the correct phase order.
- If supply voltage frequency is 60Hz, check that parameter 1-2-16 is set to 60 Hz. The hoist-monitoring unit must identify the supply voltage frequency.

14.1.7 Fault Br wear F_Brw

Hoist brake is worn out (only when the brake wear sensor is installed)

- Check the brake wear sensor
- If the sensor is connected to the terminals 21-22, check that 4-4-1 "T1 operat." is set to Bwear
- If the sensor is connected to the terminals 23-24, check that 4-5-1 "T2 operat." is set to Bwear
- If a brake wear sensor is NOT installed, make sure the function is disabled with parameters 4-4-1 and 4-5-1

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14.1.8 Fault Sensor ch. F_SCh

Measurement signal out of acceptable range

- Measure the voltage across terminals 26 (I1-A) and 30 (0V). Voltage should be between 0.5...9.5VDC (low at zero-load; high when load attached to the hook)
- Check the parameter 1-2-10 value
  - The parameter 1-2-10 value should be nearly the same as measured, ±1 VDC. If the parameter's value is different than measured value then it is possible that input is broken.
  - If the parameter 1-2-10 value is ~9.8V
    - The signal wire hasn't been connected to the Analog input 1 (the terminal 26)
    - The neutral wire is broken between the unit and the sensor
    - Check the connections between the amplifier and strain gauge sensor.
  - If the parameter 1-2-10 value is less than ~1V
  - Measure the voltage across terminal 25 (10V) and 30 (0V). Voltage should be about 10….12VDC
  - The power signal wire (10V) is broken between the terminal 25 and the sensor
  - The strain gauge sensor is not connected to the amplifier.
  - Check the connections between the amplifier and strain gauge sensor.

When the load sensor calibration is done in way, that the zero-load voltage is less than 1.0VDC, the fault only occurs when the signal becomes greater than 9.5VDC.

14.1.9 Fault Curr.meas. F_Ain

Measurement signal out of acceptable range (only two step control)

- Measure the voltage across terminals 29 (IB) and 30 (0V). Voltage should be about 5VDC
- Measure the voltage across terminals 27 (I2-A) and 29 during hoisting and lowering, low and fast speed. Voltage should be between 0.5…3 VAC, (peak values: - 4.5…+ 4.5V)
  - You can see a voltage level for all hoist motors with the nominal current from the Appendix "3.1 Current Transformer Table" of this manual
- Measure the voltage across terminals 26 (I1-A) and 29 during hoisting and lowering, low and fast speed. Voltage should be in between 0.5…3 VAC (peak values: - 4.5…+ 4.5VAC)
  - You can see a voltage level for all hoist motors with the nominal current from the Appendix "3.1 Current Transformer Table" of this manual
- Check parameter 4-7-13. Value should not be less than 0.20s.
- Check parameter 4-7-14. Value should not be less than 0.30s.

Make sure that any other electrical loads (e.g. fans, inverters) haven't been connected behind the current transformer.

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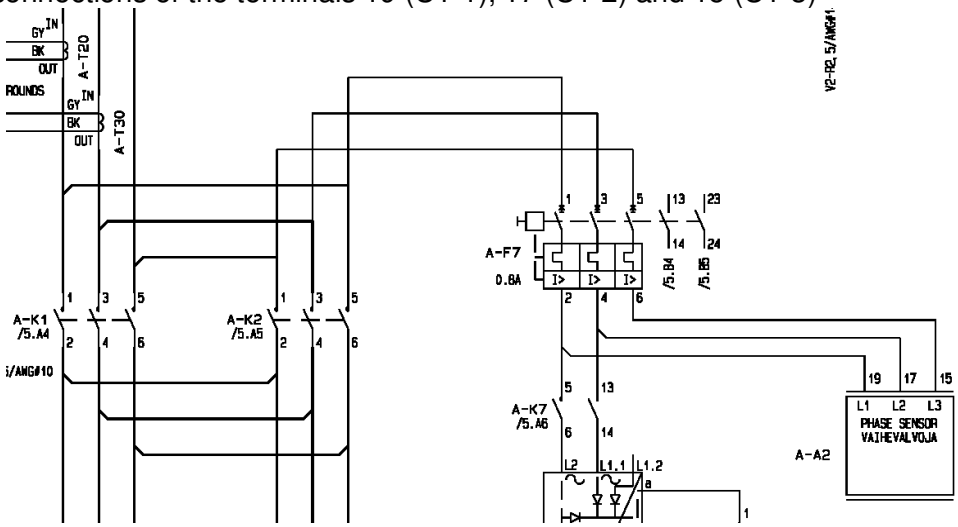
14.1.10 Fault Supply vol F_SPh

Main supply fault, one phase missing

- Check that the main voltage connects simultaneous to the control voltage
- Check the connections of the terminals 19 (U1-1), 17 (U1-2) and 15 (U1-3)



☞ In insulated or high impedance grounded networks, the zero level floats, causing errors in detecting the actual supply voltage. Set parameter 4-10-3 to NO

14.1.11 Fault Phaseorder F_Sor

Main supply fault, incorrect phase order (supervision is carried out only once after each power-ON)

- Check the connections of the terminals 19 (U1-1), 17 (U1-2) and 15 (U1-3)
- Check the phase-order
- Check the phase order of the wires through the current transformers
- Check the connections of the current transformer

☞ In insulated or high impedance grounded networks, the zero level floats, causing errors in detecting the actual supply voltage. Set parameter 4-10-3 to NO

14.1.12 Fault CParameter F_CP

Internal parameter read or write fault

- Incorrect check sum in reading the memory or internal hardware fault in the unit

14.1.13 Fault MParameter F_MP

Internal parameter read or write fault

- Incorrect check sum in reading the memory or internal hardware fault in the unit

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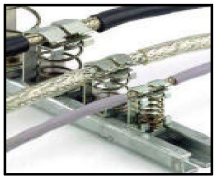
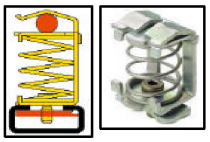
14.1.14 Fault CAN bus F_CAN

CAN bus communication fault





- Check the CAN bus wiring
- Check that the value of parameter 4-11-1 “Hoist cnt” in each unit corresponds to the number of units connected with the CAN-bus
- Check that each connected unit has an unique address, parameter 6-1 “Hoist name”
- Check with parameter 2-1 “SW version” that each connected unit has the same software version.

☞ When parameters 4-11-2 and 4-11-3 are set to YES, running is not allowed after “Fault, CAN bus”. The situation can be reset by switching the power off, and on again. This must be done for each unit, preferably simultaneously by using the main disconnect of the crane power supply. If the power off reset is done one by one, the fault may appear to be cleared in the first unit, however running is possible only after resetting all other units too

14.1.15 Fault Bridge OL F_BOL

Overload in calculated bridge load

- Check with parameter 4-11-4 “B nom load” that the load settings are the same in all connected units

14.1.16 Fault Bridge RS F_Brs

Fault in multi hoisting, requests for running not simultaneous

- Check parameter 4-11-2 “Run sup.” in each unit connected to the CAN bus. If the parameter is set to YES, the request must come simultaneously to each unit and remain active.

14.1.17 Fault Slack Rope – (2)

Slack rope function is activated

- Check parameter 4-9-1 SR select
- Check parameter 4-1-1 MFI1 oper.
- See the chapter *“Slack rope protection”* of this manual

14.2 No Signal – (2)

Communication fault

If the display shows the text “No Signal” it means that the current loop from the unit to the display provides the supply for the display but the serial data is distorted in such a way that the display is not able to read the data.

Two reasons:

- Communication fault between unit and display
  - Running possible,
  - Remote display or fault is typical in first hardware revision on the monitoring unit; all units are produced in year 2001.
  - The unit’s processor doesn’t start
- Running prevented
  - Voltage between the terminal 25 to the terminal 30 is ~0 VDC (should be ~10 … 12 VDC)
  - Unit has to be changed

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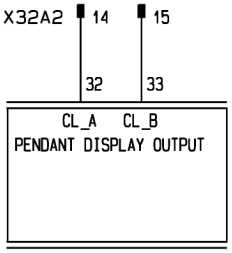
14.3 Blank display



- If display shows “blank”, check that display location selection switch position is right, logal (LOC) or remote (REM), in the monitoring unit.
- Check the connections from the unit to the display
- Change the remote display cables connections for terminals 32 and 33

14.4 The temperature sensors (NTC-wiring)

If the NTC-sensor is selected and the temperature sensor is not connected, the values for parameters 1-2-2 “Temp 1” and/or parameter 1-2-3 T2 are about -50°C.

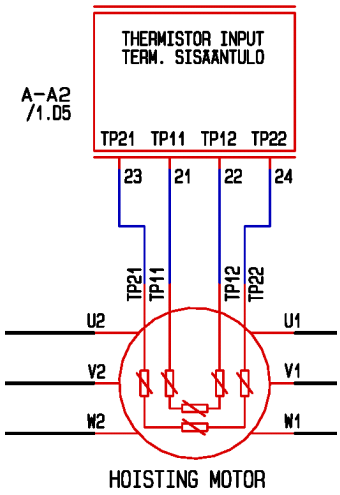
Check that temperature sensor 1 (slow speed) is connected across terminal 21 and 22 and that the slow speed temperature is measured with channel T1 (parameter 4-7-6 is set to “T1”)

When driving in slow speed, the value of parameters 1-2-2 “Temp 1” should increase.

Check that temperature sensor 2 (fast speed) is connected across terminal 23 and 24 and that the fast speed temperature is measured with channel T2 (parameter 4-7-7 is set to “T2”).

When driving in fast speed, the value of parameters 1-2-3 “Temp 2” should increase.

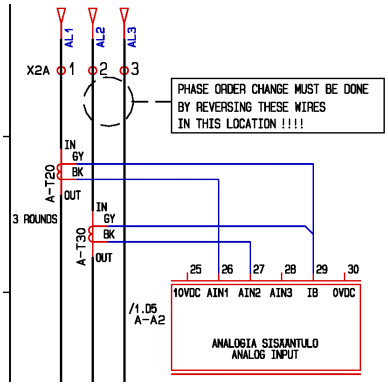
Reverse the connections of terminals 21-22 and 23-24 when needed, and carry out the calibration procedure again.



14.5 Current transformers

- Check that the current transformer AT-20 is connected across terminals 26 and 29
- Check that the current transformer AT-30 is connected across terminals 27 and 29
- The grey wires of both transformers must be connected to terminal 29.

If one of current transformers is connected wrong, it can be checked with parameters 1-2-9 “Motor I3”. In that case, parameter 1-2-9 has a different value than parameters 1-2-7 “Motor I1” and parameter 1-2-8 “Motor I2”, whereas all three should have the same value. The most common fault is that the input wire goes trough the transformers in the wrong direction.



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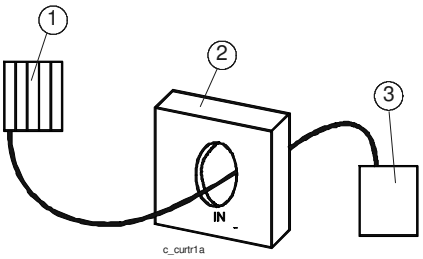
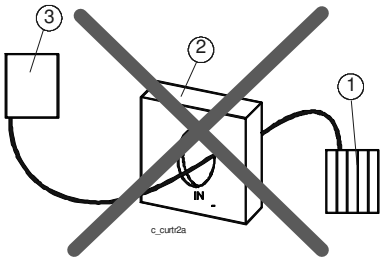
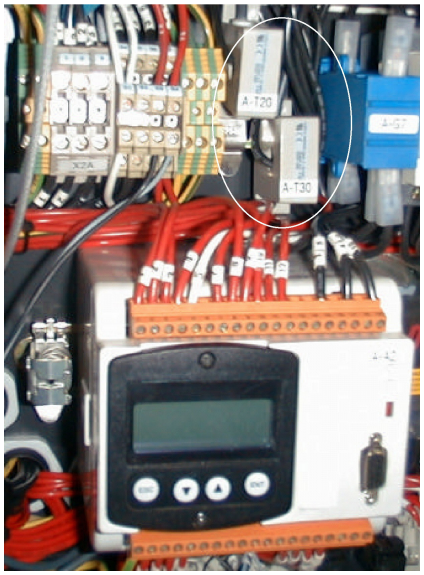
Correct wiring



Wrong wiring



1. Terminal block
2. Current transformer
3. Contactor



14.6 There is no fault, but hoist doesn't work

14.6.1 Hoisting works, but lowering is prevented

- Check the Slack Rope function with parameter 4-9-1
- Slack Rope is detected during normal operation: Decrease the Slack Rope detection level
- If the slack rope function is not needed, set to "No"
- If the slack rope function is needed in some cases but not always, consider installing a slack rope by-pass switch with either one of the MFI-inputs.

☞ SW 2.100 or later: When slack rope function is activated the unit shows "Fault Srope" on the display. If unit's software is SW 2.004 or earlier the unit doesn't show anything when slack rope is activated and lowering is prevented.

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14.6.2 Hoisting and lowering prevented

Check the input status from parameter 1-2-14

HIN	LIN	FIN	MFI1	MFI2
1	0	1	0	0

- If the unit does not receive any input commands, check the control voltage and the commanding inputs
- Check the terminal

☞ It is normal that a Voltmeter shows a disturbance value. The measured voltage may appear to be more than twice the rated control voltage, on “non-active” inputs. This voltage has however no power, and can not activate the input.

Check the output status from parameter 1-2-15

HOUT	LOUT	FOUT	RS	ROUT
1	0	1	1	1

☞ If the outputs are to be active, but the controlled device not, check the terminals, wiring and controlled device. Usually the fault “Run_FB” appears on the display.

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15Replacement Instructions

WARNING! Wrong Parameter settings can lead to a fatal malfunction of Monitoring Unit. Only authorized Service Technicians with a proper know-how about Monitoring Unit are allowed to make a replacement!

15.1 General

The Hoist-Monitoring-Unit is a multifunctional device. Different hoist types, applications and functions can be assigned by different parameter settings. Monitoring Unit is capable to gather many safety relevant data from the hoisting machinery. Based on the assigned design values, Monitoring Unit is calculating the remaining Safe Working Period (SWP%) according FEM 9.755.

If a Monitoring Unit has to be replaced with a new unit it is absolute necessary to put the correct parameters and latest data to the new unit.

15.2 Ordering a new Monitoring unit

Factories have backups of the parameter files how Monitoring Unit left production. To order a new Monitoring Unit, the factory needs following information:

- Order number, e.g. 276541 or work number, e.g. CA0815
- Hoist number, e.g. A, B,C, ….
- Unit control voltage, 48V or 115 V
- if possible: Serial No, e.g. H04711or T01234

If old parameters are send to the factory, factory can make a complete new pre-programming of the new unit.

If factory doesn't get a correct parameter file, it will download the application parameter groups 4, 5 and 6 to the new device. Parameters from group 3 and 7 must be set at the field.

15.3 Replacing

The flow diagram in chapter "Flow Chart" shows how to make a Monitoring Unit replacement.
See also **Appendix 7 Replacing the condition monitoring unit**

15.4 Parameters and Values

For a safe operation it is necessary to set the parameters in groups 3, 4, 6 and 7. To change the GO setup (General Overhaul) values group 7 has to be accessed. Access is possible with password Level 7.

If there is a record or the hoist relevant safety data from Menu 1 and Menu2, it is possible to copy this information to parameter group 7 GO-setup. In that way the SWP% value is also reliable with a new Monitoring unit. Check table on the next page.

The brake wear in Value 1-1-6 Br wear is calculated from the given brake design values in 6-19 and the brake counts in parameter 7-24. Each E-stop is counted as 50 normal stops.

Monitoring Unit can't save parameters and values in the keypad like inverter drives.

Copying following values from Menu 1 and 2 to Menu 7 when replacing an unit, makes it possible to keep the SWP values up to date.

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Read old values from old unit	Description	Last recording Value []	Estimated increase since last record	Copy value to	Set Value
1-1-4 Cycles	Counter how often a load bigger than 20% of hoist nominal load was lifted			7-1 Cycles	
1-1-7 MFI1 RT	Run time in hours from Multi Function Input 1			7-2 MFI1 RT	
1-1-8 MFI1 ST	Start counter from Multi Function Input 1			7-3 MFI1 ST	
1-1-9 MFI2 RT	Run time in hours from Multi Function Input 2			7-4 MFI2 RT	
1-1-10 MFI2 ST	Start counter from Multi Function Input 2			7-5 MFI2 ST	
2-2 RT slow	Hoist run time in hours with slow speed.			7-6 RT slow	
2-3 RT fast	Hoist run time in hours with slow speed			7-7 RT fast	
2-4 No. OT	Counter for hoisting motor over temperatures			7-8 No. OT	
2-5 No OL	Counter value for overload situations			7-9 No OL	
2-6 E-stops	Counter for emergency stops			7-10 E-stops	
2-7 ST up	Counter value for UP requests			7-11 ST up	
2-8 ST down	Counter value for DOWN requests			7-12 ST down	
2-9 ST fast	Counter value for FAST requests			7-13 ST fast	
2-10 Max ED	Max value of calculated ED percentage			7-14 Max ED	
2-11 Over ED	Minutes when the ED value has exceeded the designed values.			7-15 Over ED	
2-13 SRT3	Calculated value from Load and Run time, ^ 3			7-16 SRT3	
2-14 SRT8	Calculated value from Load and Run time, ^8			7-17 SRT8	
2-16 SL1	Calculated value from Load and Cycles, ^1			7-18 SL1	
2-17 SL3	Calculated value from Load and Cycles, ^3			7-19 SL3	
2-18 SL8	Calculated value from Load and Cycles, ^8			7-20 SL8	
2-19 Power on	Total hours when the unit was powered on.			7-21 Power on	must be 0
2-20 Temp index	Power on time weighted with unit's temperature.			7-22 Temp index	must be 0
2-21 Max Load	The highest measured load.			7-23 Max Load	

6-18 Max Br	Max designed brake operations.			7-24 Brake operation counter	
1-1-6 Br SWP%	Counter of Stops and E-Stops				

☞ If only Monitor 1-Condition monitoring menu's values are read, some parameter values are possible to calculate to menu 7.

	Description	Read old values from old unit	Set value	Desing values from parameter
7-1 Cycles	Counter how often a load bigger then 30% of hoist nominal load was lifted	1-1-4 Cycles	Set the parameter's 1-1-4 Cycles value	
7-2 MFI1 RT	Run time in hours from Multi Function Input 1	1-1-7 MFI1 RT	Set the parameter's 1-1-7 MFI1 RT value	
7-3 MFI1 ST	Start counter from Multi Function Input 1	1-1-8 MFI1 ST	Set the parameter's 1-1-8 MFI1 ST value	
7-4 MFI2 RT	Run time in hours from Multi Function Input 2	1-1-9 MFI2 RT	Set the parameter's 1-1-9 MFI2 RT value	
7-5 MFI2 ST	Start counter from Multi Function Input 2	1-1-10 MFI2 ST	Set the parameter's 1-1-10 MFI2 ST value	
7-6 RT slow	Hoist run time in hours with slow speed.	1-1-3 Run time	$RT\_slow = Run\_time * 0{,}25$	
7-7 RT fast	Hoist run time in hours with slow speed	1-1-3 Run time	$RT\_fast = Run\_time * 0{,}75$	
7-8 No. OT	Counter for hoisting motor over temperatures		Set to 0	
7-9 No OL	Counter value for overload situations		Set to 0	
7-10 E-stops	Counter for emergency stops		Set to 0	
7-11 ST up	Counter value for UP requests	1-1-2 Starts	$ST\_up = Starts * 0{,}5$	
7-12 ST down	Counter value for DOWN requests	1-1-2 Starts	$ST\_down = Starts * 0{,}5$	
7-13 ST fast	Counter value for FAST requests	1-1-2 Starts	$ST\_fast = Starts * 0{,}75$	
7-14 Max ED	Max value of calculated ED percentage		Set to 0	
7-15 Over ED	Minutes when the ED value has exceeded the designed values.		Set to 0	
7-16 SRT3	Calculated value from Load and Run time, ^ 3	1-1-1 SWP%	$SRT3 = \frac{SWP\%}{100\%} * D\_SRT3$	6-10 D_SRT3
7-17 SRT8	Calculated value from Load and Run time, ^8		Set to 0	

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	Description	Read old values from old unit	Set value	Desing values from parameter
7-18 SL1	Calculated value from Load and Cycles, ^1		Set to 0	
7-19 SL3	Calculated value from Load and Cycles, ^3	1-1-1 SWP%	$SL3 = \frac{SWP\%}{100\%} * D\_SL3$	6-12 D_SL3
7-20 SL8	Calculated value from Load and Cycles, ^8		Set to 0	
7-21 Power on	Total hours when the unit was powered on.		Set to 0	
7-22 Temp index	Power on time weighted with unit's temperature.		Set to 0	
7-23 Max Load	The highest measured load.		Set to 0	
7-24 Br.Count	Brake operation counter	1-1-6 Br SWP%	$Br\_Count = \frac{Br\_SWP\%}{100\%} * Max\_Br$	6-18 Max Br

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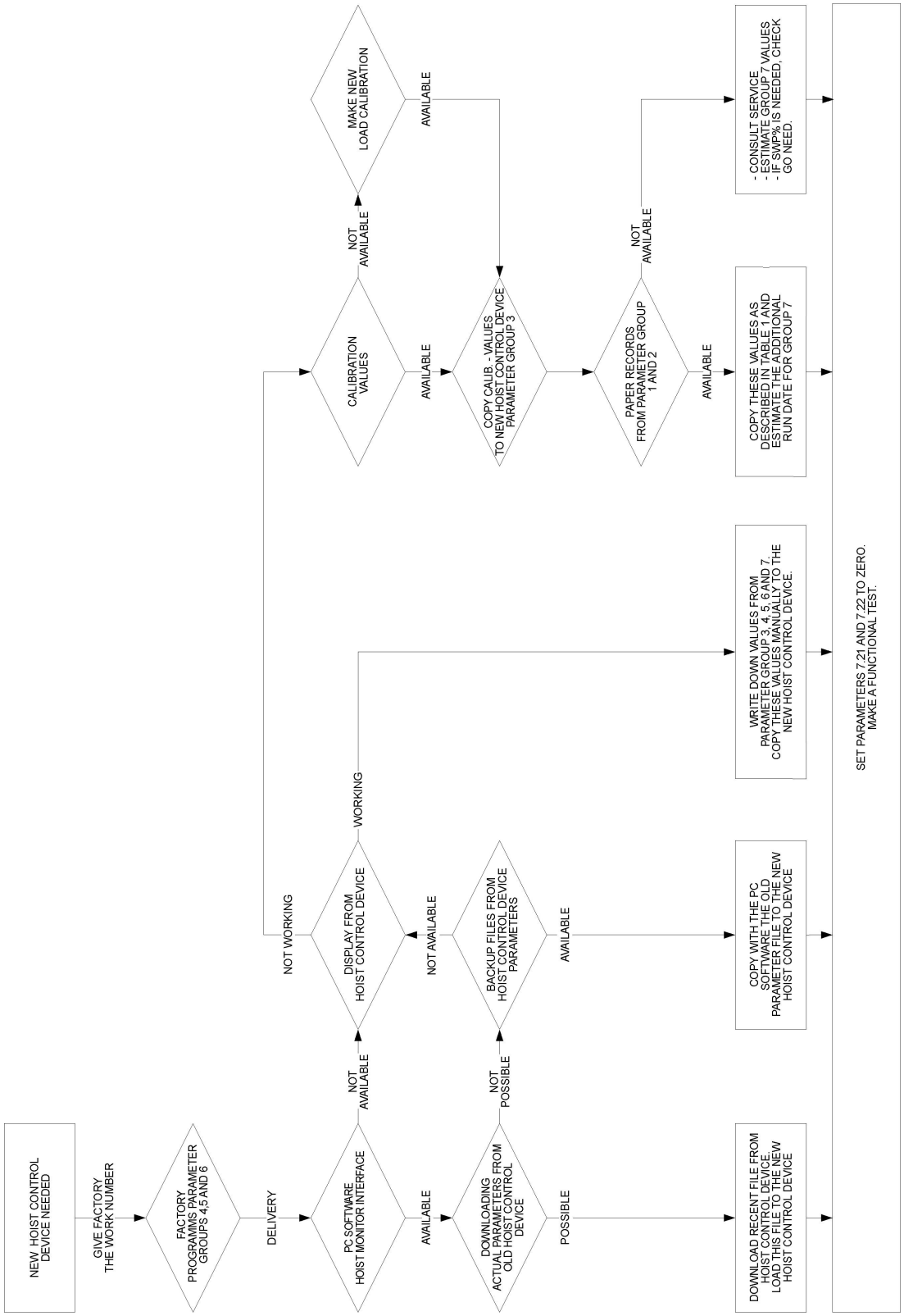
15.5 Flow chart



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16Menu structure

16.1 Monitor 1 (Menu 1)

1	**Monitor 1**		**Read only menu for condition monitoring values and measured values. Accessible with the customer's password.**

Param.	Name	Value	Description
1-1	**Cond mon**		**Condition monitoring menu**
1-1-1	SWP%	"n" %	Remaining Safe Working Period of the hoist in percentage, starting from 100%. When the SWP counter descends to 0% (or even negative), a General Overhaul must be carried out.
1-1-2	Starts	"n"	Total number of starts of the hoist in either up or down direction. *1)
1-1-3	Run time	"n" h	Total running time of the hoist in hours. *2)
1-1-4	Cycles	"n"	Total number of hoisting cycles. *1). The number increases by one, when a load value increase more than 20% of the rated load is lifted.
1-1-5	Mean load	"n.n" t	Average of the handled load during the recorded cycles.
1-1-6	Br SWP%	"n" %	Remaining Safe Working Period of the brake in percentage. The SWP for the brake is calculated according to the number of Starts and E-stops.
1-1-7	MFI1 RT	"n" h	Total hours of running time, when MFI1 input is closed. Can be used to monitor the total running time of another machinery (i.e. the trolley drive). Active only if parameter 4-1-1 is set to *"ST/RT"* and the MFI1 input is connected. *2)
1-1-8	MFI1 ST	"n"	Total amount of starts, when MFI1 input is closed. Can be used to monitor the total amount of starts of another machinery (i.e. the trolley drive). Active only if parameter 4-1-1 is set to *"ST/RT"* and the MFI1 input is connected. *1)
1-1-9	MFI2 RT	"n" h	Total hours of running time, when MFI2 input is closed. Can be used to monitor the total running time of another machinery (i.e. the bridge drive). Active only if parameter 4-2-1 is set to *"ST/RT"* and the MFI2 input is connected. *2)
1-1-10	MFI2 ST	"n"	Total amount of starts, when MFI2 input is closed. Can be used to monitor the total amount of starts of another machinery (i.e. the bridge drive). Active only if parameter 4-2-1 is set to *"ST/RT"* and the MFI2 input is connected *1)

The values on the display are present with five digits.
*1) there is no unit name, all five digits are used to show the value.
The letter "k" appears when the value is greater than 99.999, indicating the full thousands.
The letter "M" appears when the value is greater than 1.000.000, indicating the full millions.
*2) a unit name is used (i.e. hours "h"), there are only four digits available to present the value.
The letter "k" appears when the value is greater than 9.999, indicating the full thousands.
The letter "M" appears when the value is greater than 1.000.000, indicating the full millions.
A dot will appear on the correct spot to indicate the decimals

Param.	Name	Value	Description
1-2	**Measure**		**Measurement menu**
1-2-1	Act. Load	"n.n" t	The measured actual load value of the solo hoist connected to the unit.
1-2-2	Temp 1	"nnn" C	Temperature measured at thermistor input 1. Only functional when par. 4-4-1 is set to ""x"NTC" and a NTC-type of thermistor is connected across terminals X2: 21-22. Otherwise the display shows "NA" (Not Available)
1-2-3	Temp 2	"nnn" C	Temperature measured at thermistor input 2. Only functional when par. 4-5-1 is set to ""x"NTC" and a NTC-type of thermistor is connected across terminals X2: 23-24. Otherwise the display shows "NA" (Not Available)
1-2-4	Supply L1	"nnn" V	RMS line voltage of phase L1, measured at terminal X1: 19; VAC
1-2-5	Supply L2	"nnn" V	RMS line voltage of phase L2, measured at terminal X1: 17; VAC
1-2-6	Supply L3	"nnn" V	RMS line voltage of phase L3, measured at terminal X1: 15; VAC
1-2-7	Motor I1	"nn.n" A	RMS motor current of phase U. Only functional when par. 4-7-1 is set to "Motor"
1-2-8	Motor I2	"nn.n" A	RMS motor current of phase V. Only functional when par. 4-7-1 is set to "Motor"
1-2-9	Motor I3	"nn.n" A	RMS motor current of phase W. Only functional when par. 4-7-1 is set to "Motor"
1-2-10	Ain1 value	"n.nn" V	Measured voltage at analogue input AIN1. Voltage across terminals X2: 26-30; VDC
1-2-11	Ain2 value	"n.nn" V	Measured voltage at analogue input AIN2. Voltage across terminals X2: 27-30; VDC
1-2-12	Ain3 value	"n.nn" V	Measured voltage at analogue input AIN3. Note that there is no function behind AIN3. This input can be

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Param.	Name	Value	Description
1-2	**Measure**		**Measurement menu**
			used for measurement purposes only
1-2-13	Int. temp	"n" C	Internal temperature of the unit.
1-2-14	Input	i.e.: 10101	Indicates the status of the inputs: HIN, LIN, FIN, MFI1 & MFI2. "1" means active, "0" means inactive. Note that the leftmost "zeros" before the first appearing "1" are not displayed
1-2-15	Output	i.e.: 10100	Indicates the status of the outputs: HOUT, LOUT, FOUT, RS & ROUT. "1" means active, "0" means inactive. Note that the leftmost "zeros" before the first appearing "1" are not displayed
1-2-16	Supply f	50	Supply voltage frequency (50 or 60Hz)

Param.	Name	Value	Description
1-3	**Min/Max**		**Minimum / maximum value menu**
1-3-1	Min supply	"nnn" V	Minimum measured value of the supply line voltage RMS.
1-3-1	Reset ?	"nnn" V	Resets the value shown in parameter 1-3-1 by pushing the ENT button twice
1-3-2	Max supply	"nnn" V	Maximum measured value of the supply line voltage RMS.
1-3-2	Reset ?	"nnn" V	Resets the value shown in parameter 1-3-2 by pushing the ENT button twice
1-3-3	Min Int. T	"n" C	Minimum measured value of the internal temperature of the unit.
1-3-3	Reset ?	"n" C	Resets the value shown in parameter 1-3-3 by pushing the ENT button twice
1-3-4	Max Int. T	"n" C	Maximum measured value of the internal temperature of the unit.
1-3-4	Reset ?	"n" C	Resets the value shown in parameter 1-3-4 by pushing the ENT button twice

16.2 Monitor 2 (Menu 2)

2	**Monitor 2**		**Read only menu for advanced condition monitoring values and measured values. Accessible with password level 3**

Param.	Name	Value	Description
2-1	**SW version**	**2.000**	**Software version of the unit**
2-2	RT slow	"nnn" h	Total run-time in slow speed *2)
2-3	RT fast	"nnn" h	Total run-time in fast speed *2)
2-4	No. OT	"nnn"	Total number of hoist motor over temperature incidents.
2-5	No. OL	"nnn"	Total number of overload incidents
2-6	E-stops	"nnn"	Total number of emergency stops incidents (control voltage switched off during run).
2-7	ST up	"nnnn"	Total number of starts in up direction *1)
2-8	ST down	"nnnn"	Total number of starts in down direction *1)
2-9	ST fast	"nnnn"	Total number of starts to fast speed (counts in two speed control only) *1)
2-10	Max ED	"nn" %	Maximum value of the calculated ED percentage
2-10	Reset ?	"nn" %	Resets the value shown in parameter 2-10 by pushing the ENT button twice
2-11	Over ED	"nn"	Counts the minutes when ED value has exceed the nominal ED value
2-12	SWPRT%	"nn" %	SWP% value calculated with hoist running time
2-13	SRT3	"nnnn"	Load sum with hoist running time, third power *1)
2-14	SRT8	"nnnn"	Load sum with hoist running time, eight power *1)
2-15	SWPHC%	"nn" %	SWP% value calculated with hoist cycles
2-16	SL1	"nnnn"	Load sum with hoist cycles, the first power (mean load) *1)
2-17	SL3	"nnnn"	Load sum with hoist cycles, the third *1)
2-18	SL8	"nnnn"	Load sum with hoist cycles, the eight power *1)
2-19	Power on	"nnnn" h	The total power on time of the unit *2)
2-20	Temp Index	"nnnn" h	Power on time of the unit, weighted with the unit's temperature *2)
2-21	Max load	"nnn" %	Maximum measured value of the load
2-21	Reset ?	"nnn" %	Resets the value shown in parameter 2-21 by pushing the ENT button twice

The values on the display are present with five digits.
*1) there is no unit name, all five digits are used to show the value.
The letter "k" appears when the value is greater than 99.999, indicating the full thousands.
The letter "M" appears when the value is greater than 1.000.000, indicating the full millions.
*2) a unit name is used (i.e. hours "h"), there are only four digits available to present the value.
The letter "k" appears when the value is greater than 9.999, indicating the full thousands.
The letter "M" appears when the value is greater than 1.000.000, indicating the full millions.
A dot will appear on the correct spot to indicate the decimals

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16.3 Load calibration menu (Menu 3)

3	Load setup		Load calibration menu. Accessible password level 2

Param.	Name	Value	Description
3-1	**Cal. Motor**		**Load calibration when the motor torque based load measurement is selected. *See chapter* "Load calibration sequence with motor torque"**
3-1-1	Set>80%	"nn.n" t	Set the higher test load value in tons (80%…130% × hoist rated load)
3-1-2	"nn.n"t OK ?		Confirm the set test load value by pushing the ENT button (make sure the test load is attached to the hook)
3-1-3	Up, slow		Drive the hoist upward in slow speed as long as the message appears.
3-1-4	Up, fast		Drive the hoist upward in fast speed as long as the message appears.
3-1-5	Down, slow		Drive the hoist downward in slow speed as long as the message appears.
3-1-6	Down, fast		Drive the hoist downward in fast speed as long as the message appears.
3-1-7	Set<30%	"nn.n" t	Set the lower test load value in tons (<30% of hoist rated load), typically empty hook (0.00t)
3-1-8	"nn.n" t OK ?		Confirm the set second test load value by pushing the ENT button (make sure the hook is empty when 0.00t is given in parameter 3-1-7, or that the set second test load is attached to the hook)
3-1-9	Up, slow		Drive the hoist upward in slow speed as long as the message appears.
3-1-10	Up, fast		Drive the hoist upward in fast speed as long as the message appears.
3-1-11	Down, slow		Drive the hoist downward in slow speed as long as the message appears.
3-1-12	Down, fast		Drive the hoist downward in fast speed as long as the message appears.

Param.	Name	Value	Description
3-2	**MC values**		**Load calibration values for the motor torque method**
3-2-1	Load 1	"nn.n" t	The higher test load value set with parameter 3-1-1
3-2-2	Mhs1	"nn.nn"	Motor torque for hoisting in slow speed, with load set by parameter 3-1-1
3-2-3	Mhf1	"nn.nn"	Motor torque for hoisting in fast speed, with load set by parameter 3-1-1
3-2-4	Mls1	-"nn.n"	Motor torque for lowering in slow speed, with load set by parameter 3-1-1
3-2-5	Mlf1	-"nn.n"	Motor torque for lowering in fast speed, with load set by parameter 3-1-1
3-2-6	Load 2	"nn.n" t	The lower test load value set with parameter 3-1-7
3-2-7	Mhs2	"nn.nn"	Motor torque for hoisting in slow speed, with load set by parameter 3-1-7
3-2-8	Mhf2	"nn.nn"	Motor torque for hoisting in fast speed, with load set by parameter 3-1-7
3-2-9	Mls2	-"nn.n"	Motor torque for lowering in slow speed, with load set by parameter 3-1-7
3-2-10	Mlf2	-"nn.n"	Motor torque for lowering in fast speed, with load set by parameter 3-1-7

Param.	Name	Value	Description
3-3	**Cal. Sens**		**Load calibration when the sensor based load measurement is selected .*See chapter* "Load calibration sequence load sensor."**
3-3-1	Set>80%	"nn.n" t	Set the higher test load value in tons (80%…130% × hoist rated load)
3-3-2	"nn.n"t OK ?		Confirm the set higher test load value by pushing the ENT button (make sure the test load is attached to the hook)
3-3-3	Set<30%	"nn.n" t	Set the lower test load value in tons (<30% of hoist rated load), typically empty hook (0.00t)
3-3-4	"nn.n" t OK ?		Confirm the set lower test load value by pushing the ENT button (make sure the hook is empty when 0.00t is given in parameter 3-3-3, or that the set second test load is attached to the hook)

Param.	Name	Value	Description
3-4	**SC values**		**Load calibration values for the load sensor method**
3-4-1	Load 1	"nn.n" t	The higher test load value set with parameter 3-3-1
3-4-2	Input 1	"n.nn" V	The load measurement voltage in the analogue input Ain1 corresponding to the test load
3-4-3	Load 2	"nn.n" t	The lower test load value set with parameter 3-3-3
3-4-4	Input 2	"n.nn" V	The load measurement voltage in the analogue input Ain1 corresponding to the load 2

Param.	Name	Value	Description
3-5	**OL protect**	**ON**	**Set to "OFF" to temporarily by-pass of the overload protection. OFF state automatically switches to ON state after power off, or after 30 minutes activating the OFF state. When rated load is over 110% then hoisting is only possible with slow speed!**

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16.4 Start-up menu (Menu 4)

4	Start-up		Start- menu. Accessible password level 4

Param.	Name	Value	Description	
4-1	**MFI1**		**Multi-Functional Input 1 parameters**	
4-1-1	MFI1 oper.	NU	Selects the function of MFI1:	
			NU	Not used
			IntL	Intermediate load limit
			Tare	Load tare
			SRope	Slack rope by-pass
			ST/RT	Start and run-time counter
			2OLL	Second overload limit
			Level	Levelling limit switch function in common hoisting
			CintL	Intermediate load limit in common hoisting
			CAN	CAN bus by-pass
4-1-2	MFI1 IntL	”nn.n” t	When “IntL” is chosen with parameter 4-1-1, the (first) intermediate load limit value is entered here (in tons). Range: 0…hoist rated load	
4-1-3	MFI1 2OLL	”n.nn”	When 2OLL is chosen with parameter 4-1-1, the coefficient for the second load limit is entered here. Range: 1.00…1.30	
4-1-4	MFI1 CintL	“nn.n” t	When “CintL” is chosen with parameter 4-1-1, (the first) bridge intermediate load limit value is entered here (in tons). Range: 0…bridge rated load	

Param.	Name	Value	Description	
4-2	**MFI2**		**Multi-Functional Input 2 parameters**	
4-2-1	MFI2 oper.	NU	Selects the function of MFI2:	
			NU	Not used
			IntL	Intermediate load limit
			Tare	Load tare
			SRope	Slack rope by-pass
			ST/RT	Start and run-time counter
			2OLL	Second overload limit
			Level	Levelling limit switch function in common hoisting
			CintL	Intermediate load limit in common hoisting
			CAN	CAN bus by-pass
4-2-2	MFI2 IntL	”nn.n” t	When “IntL” is chosen with parameter 4-2-1, the (second) intermediate load limit value is entered here (in tons). Range: 0…hoist rated load	
4-2-3	1+2 IntL	“nn.n” t	When “IntL” is chosen with both parameters 4-1-1 and 4-2-1, the third intermediate load limit value is entered here (in tons). Range: 0…hoist rated load	
4-2-4	MFI2 2OLL	”n.nn”	When 2OLL is chosen with parameter 4-2-1, the coefficient for the second load limit is entered here. Range: 1.00…1.30	
4-2-5	MFI2 CintL	“nn.n” t	When “CintL” is chosen with parameter 4-2-1, the (second) bridge intermediate load limit value is entered here (in tons). Range: 0…bridge rated load	
4-2-6	1+2 CintL	“nn.n” t	When “CintL” is chosen with both parameter 4-1-1 and 4-2-1, the third bridge intermediate load limit value is entered here (in tons). Range: 0…bridge rated load	

Param.	Name	Value	Description	
4-3	**ROUT**		**Relay output parameters**	
4-3-1	ROUT oper.	NU	Selects the function of the relay output	
			NU	Not used
			OL	Overload: Hoist in overload; contact closed Bridge in overload; contact closed; since SW 2.100
			LoadX	Load limit: Load greater than limit set by parameter 4-3-3; contact closed
			OK	Normal; contact closed. Warning; contact blinks. Fault; contact open
			Ready	Normal; contact closed. Fault; contact open
			TempX	Temperature limit: Temperature greater than limit set by parameter 4-3-4; contact closed
4-3-2	ROUT logic	Norm	The operation logic of the relay: Norm Normal operation as described above (4-3-1) Inv Operation inverted compared to the description above (4-3-1)	

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Param.	Name	Value	Description
4-3	**ROUT**		**Relay output parameters**
4-3-3	ROUT LoadX	"nn.n" t	When "LoadX" is chosen with parameter 4-3-1, the load limit to switch the relay is entered here (in tons). Range: 0…hoist rated load. Note: Functions only for the hoist connected to the unit!
4-3-4	TempX meas	T1	When "TempX" is chosen with parameter 4-3-1, the temperature measurement operation is chosen here: T1: Temperature measurement channel T1 determines the limit. T2: Temperature measurement channel T2 determines the limit. T1+2: Both temperature measurement channels are used, the first one to reach the limit will trip the relay
4-3-5	TempX lim	"nnn" C	When "TempX" is chosen with parameter 4-3-1, the temperature limit is entered here

Param.	Name	Value	Description	
4-4	**T1**		**Temperature measurement channel 1 parameters**	
4-4-1	T1 operat.		Selects the function of temperature measurement channel 1:	
			NU	Not used
			PTC	Motor thermistor or Bimetal thermal switch
			Bwear	Brake wear sensor
			A NTC	Type A NTC sensor
			B NTC	Type B NTC sensor
			C NTC	Type C NTC sensor

Param.	Name	Value	Description	
4-5	**T2**		**Temperature measurement channel 2 parameters**	
4-5-1	T2 operat.		Selects the function of temperature measurement channel 1:	
			NU	Not used
			PTC	Motor thermistor or Bimetal thermal switch
			Bwear	Brake wear sensor
			A NTC	Type A NTC sensor
			B NTC	Type B NTC sensor
			C NTC	Type C NTC sensor

Param.	Name	Value	Description	
4-6	**AOUT**		**Analogue output parameters**	
4-6-1	AOUT oper.	NU	Selects the function of the analogue output	
			NU	Not used
			Act	Actual load (actual bridge load in multi-hoist applications)
			Tare	Tared load (tared bridge load in multi-hoist applications)
			Solo	Actual load for single hoist connected to the unit.
4-6-2	Zero load	"n.nn" V	Sets the voltage level with zero-load. Range 0…10V	
4-6-3	Nom. Load	"n.nn" V	Sets the voltage level with rated load. Range 0…10V The single hoist the rated load is determined by parameter 6-4, the rated bridge load is determined by parameter 4-11-4.	

Param.	Name	Value	Description	
4-7	**Load param**		**Load calculation parameters**	
4-7-1	Load meas.		Selects the load calculation method:	
			NU	Not used
			Motor	Motor torque calculation
			Sens.	Load sensor measurement
4-7-2	Load rate%	10	Load increase rate for controlling the hoisting in two step control, speed change to fast speed is allowed when actual load change within 200ms < parameter 4-7-2. Value 0% means that the function is not applied. See also chapter ***"Sudden load increase supervision"*** of this manual.	
4-7-3	R0_F	"n.nnn"	Resistance of fast speed windings at temperature T0	
4-7-4	R0_S	"n.nnn"	Resistance of slow speed windings at temperature T0	
4-7-5	T0	"nn" C	Resistance measuring temperature T0	
4-7-6	Temp_slow	T1	Temperature measurement channel for the motor slow speed windings, used in motor torque calculation	
			T1	Temperature measurement channel T1 (terminals X2:21-22)
			T2	Temperature measurement channelT2 (terminals X2:23-24)
			NU	Temperature measurement not used

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Param.	Name	Value	Description	
4-7	**Load param**		**Load calculation parameters**	
4-7-7	Temp_fast	T2	Temperature measurement channel for the motor fast speed windings, used in motor torque calculation	
			T1	Temperature measurement channel T1 (terminals X2:21-22)
			T2	Temperature measurement channelT2 (terminals X2:23-24)
			NU	Temperature measurement not used
4-7-8	C2F	nnnn	Coefficient 2 for fast speed	
4-7-9	C2S	nnnn	Coefficient 2 for slow speed	
4-7-10	C1F	nnnn	Coefficient 1 for fast speed	
4-7-11	C1S	nnnn	Coefficient 1 for slow speed	
4-7-12	ki	nnnn	Reduction factor for current transformer [A/V]	
4-7-13	Acc-t slow	0.20s	Acceleration time from stop to slow speed. Range 0.00…1.00 sec. See also chapter ***"Starting and stopping through slow speed"*** of this manual	
4-7-14	Acc-t fast	0.30s	Acceleration time from slow speed to fast speed. Range 0.00…1.00 sec. See also chapter ***"Starting and stopping through slow speed"*** of this manual	

Param.	Name	Value	Description	
4-8	**Hoist ctrl**		The selection for the hoist control method	
			2-SP	Two step control
			INV	Stepless control (i.e. Inverter drives)

Param.	Name	Value	Description	
4-9	**Slack rope**		**Slack rope function parameters**	
4-9-1	SR select		Selects the slack rope function	
			Yes	Selected
			No	Not selected
4-9-2	Load limit	"nn.n" t	When "YES" is chosen with parameter 4-9-1, the slack rope limit is entered here (in tons). Range: 0…hoist rated load. Recommended value: 10…50% of rated load of the hoist.	

Param.	Name	Value	Description	
4-10	**Single sup**			
4-10-1	OT run ?	No	Selects the action when the motor temperature exceeds the limit or when "Fault, Br wear" occurs	
			No	Both hoisting and lowering is prevented
			Down	Hoisting is prevented, lowering is allowed
4-10-2	OT limit	"nnn" C	When NTC type sensor is applied (P4-4-1 and P4-5-1) the limit value for the hoist motor overtemperature supervision in given here in degrees Celsius, with the resolution of one degree. When the given limit is exceeded, the overtemperature supervision is triggered. Once activated, the supervision remains active until the motor temperature has descended 30°C under the given limit value.	
4-10-3	Supply sup	YES	Selects the supply voltage supervision.	
			YES	Supply voltage supervision is active
			NO	Supply voltage supervision is not applied
			The supply voltage supervision checks the phase order and the presence of all phases (L1, L2 & L3) In insulated or high impedance grounded networks, selection must be NO When the control method is stepless speed control (parameter 4-8 is "INV"), selection must be NO	

Param.	Name	Value	Description	
4-11	**Comm hoist**		**The settings for common hoisting (multi-hoist applications)**	
4-11-1	Hoist cnt	"n"	The number of units connected with CAN bus. Range: 1…5	
4-11-2	Run sup.		Common hoisting supervision	
			YES	Run supervisions between hoists are active
			NO	No run supervision between hoists
4-11-3	B OL		Bridge overload protection	
			YES	active
			NO	not active
4-11-4	B nom load	"nn.n" t	Rated load of the bridge	

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16.5 Service menu (Menu 5)

5	Service		Start- menu. Accessible password level 5

Param.	Name	Value	Description
5-1	**S limits**		**The limit values to indicate the need for service. A service warning is displayed in case one of the values exceeds the given limit.**
5-1-1	S Run time	"nnnn" h	Run time service limit
5-1-2	S starts	"nnnnn"	Service limit for the number of starts
5-1-3	S SWP%	"nn" %	Service limit for SWP%
5-1-4	S Br SWP%	"nn" %	Service limit for the hoist brake service life

Param.	Name	Value	Description
5-2	**Fault log**	**"n"**	**The logger for the latest fault situations, the number "n" indicates the number of faults in the logger**
5-2-1	F_"XXX"	"nnnnn"	The latest fault. The fault code "XXX" and the actual number of starts "nnnnn" at the moment when the fault was detected. Refer to chapter ***"Faults"*** for the fault descriptions
5-2-2	F_"XXX"	"nnnnn"	The second latest fault. The fault code "XXX" and the actual number of starts "nnnnn" at the moment when the fault was detected. Refer to chapter ***"Faults"*** for the fault descriptions
5-2-"n"	F_"XXX"	"nnnnn"	The "n" latest fault (highest number is 30). The fault code "XXX" and the actual number of starts "nnnnn" at the moment when the fault was detected. Refer to chapter ***"Faults"*** for the fault descriptions

Param.	Name	Value	Description
5-3	**Reset log**	**"n"**	**Resets the fault log by pushing the ENT button. The number "n" indicates the amount of faults presently in the logger.**
5-3	Reset log ?		The reset action must be confirmed by pushing the ENT button once more

16.6 Design values menu (Menu 6)

6	Design		Design values menu. Accessible password level 6

Param.	Name	Value	Description
6-1	Hoist name	"X"	Identifying letter of the hoist-monitoring unit, A, B, C, D or E. Each connected unit in a multi-hoist application, connected via the CAN-bus must have a unique letter.
6-2	Unit No	"nnnnn"	The serial number of the hoist. Setting is informative only, there is no function behind the value.
6-3	Class	"n"	Mechanical class for the hoist according to the FEM / ISO duty classes. See chapter ***"Primary monitoring items"*** of this manual for details. Setting is informative only, there is no function behind the value.
6-4	Nom. Load	"nn.n" t	Rated load of the single hoist connected to the unit
6-5	Nominal ED	"nn" %	Rated ED value of the hoist
6-6	Sp ratio	"n"	Speed ratio. Two-speed systems: slow-fast (i.e. 6), inverter drives: always 1
6-7	Max ST	"nnnnn"	Maximum allowed number of starts
6-8	Max E-stop	"nnnnn"	Maximum allowed number of interrupted hoists (emergency stops)
6-9	Max RT	"nnnn" h	Maximum allowed run-time in hours
6-10	D SRT3	"nnnnn"	Designed running hours, power three. Equals the safe working period in hours as described in chapter ***"Primary monitoring items"*** of this manual.
6-11	D SRT8	"nnnnn"	Designed running hours, power eight. Equals the safe working period in hours as described in chapter ***"Primary monitoring items"*** of this manual.
6-12	D SL3	"nnnnn"	Design constraint for hoisting cycles, power three
6-13	D SL8	"nnnnn"	Design constraint for hoisting cycles, power eight
6-14	MaxST MFI1	"nnnnn"	Max number of MFI1 starts. See chapter ***"Run time and start counter for trolley and bridge"*** for details
6-15	MaxRT MFI1	"nnnn" h	Max running time for MFI1. See chapter ***"Run time and start counter for trolley and bridge"*** for details
6-16	MaxST MFI2	"nnnnn"	Max number of MFI2 starts. See chapter ***"Run time and start counter for trolley and bridge"*** for details
6-17	MaxRT MFI2	"nnnn" h	Max running time for MFI2. See chapter ***"Run time and start counter for trolley and bridge"*** for details
6-18	Max Br	"nnnnn"	Max number of braking actions, for calculating the brake's life-time
6-19	Max Control	"nnnnn"	Max number of Control, for calculating the contactors' life-time
6-20	Password	"nnnn"	Set password level 1 (4digits). Customer password or device related password.

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16.7 GO –settings menu (Menu 7)

Values are equal to the ones in Menu 1 and/or Menu 2 (monitoring items). After a General Overhaul has been performed, these parameter have to be reset to the original value (zero) unless otherwise indicated

7	**GO-setup**		**GO-settings menu. Accessible with password level 7**

Param.	Name	Value	Description
7-1	**Cycles**	**"nnnnn"**	**Number of hoisting cycles**
7-2	MFI1 RT	"nnnn" h	MFI1 running time
7-3	MFI1 ST	"nnnnn"	MFI1 starts
7-4	MFI2 RT	"nnnn" h	MFI2 running time
7-5	MFI2 ST	"nnnnn"	MFI2 starts
7-6	RT slow	"nnnn" h	Run-time in slow speed
7-7	RT fast	"nnnn" h	Run-time in fast speed
7-8	No. OT	"nnnnn"	Number of hoist motor overtemperature incidents. Reset when the hoisting motor has been replaced
7-9	No. OL	"nnnnn"	Number of hoist overload incidents
7-10	E-stops	"nnnnn"	Number of emergency stops
7-11	ST up	"nnnnn"	Number of starts in up direction
7-12	ST down	"nnnnn"	Number of starts in down direction
7-13	ST fast	"nnnnn"	Number of starts to fast speed (two step control only)
7-14	Max ED	"nn" %	Maximum ED value
7-15	Over ED	"nnnnn"	Number of cases where ED value has exceeded the rated ED value
7-16	SRT3	"nnnnn"	Load sum with hoist running time, third power
7-17	SRT8	"nnnnn"	Load sum with hoist running time, eight power
7-18	SL1	"nnnnn"	Load sum with hoist cycles, the first power (mean load)
7-19	SL3	"nnnnn"	Load sum with hoist cycles, the third power
7-20	SL8	"nnnnn"	Load sum with hoist cycles, the eight power
7-21	Power on	"nnnn" h	The total power on time for hoist control unit
7-22	Temp Index	"nnnn" h	The power on time weighted with the hoist control unit temperature
7-23	Max load	"nnnn" %	The maximum value of the measured load
7-24	Br Count	"nnnnn"	The brake wear counter. Counts the number of stop-actions to calculate the BrSWP%. Reset when the hoisting brake has been replaced

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Appendix 1 - Default parameters

All values are default values and can alter from application to application.

Abbreviations:

- \- no effect because NU
- C Calibration value
- I only for Info
- D Design Value

Hoist Control: / Load Measurement:		2 Speeds Motor	2 Speeds Sensor	Inverter Sensor
3 Load Setup				
3-2-1	Load 1	C	-	-
3-2-2	Mhs1	C	-	-
3-2-3	Mhf1	C	-	-
3-2-4	Mls1	C	-	-
3-2-5	Mlf1	C	-	-
3-2-6	Load 2	C	-	-
3-2-7	Mhs2	C	-	-
3-2-8	Mhf2	C	-	-
3-2-9	Mls2	C	-	-
3-2-10	Mlf2	C	-	-
3-4-1	Load 1	-	C	C
3-4-2	Input 1	-	C (~2)	C (~2)
3-4-3	Load 2	-	C	C
3-4-4	Input 2	-	C (~5)	C (~5)
3-5	OL protect	On	On	On
4 Start-up				
4-1-1	MFI1 oper.	NU	NU	NU
4-1-2	MFI1 IntL	-	-	-
4-1-3	MFI 2OLL	-	-	-
4-1-4	MFI1 CintI	-	-	-
4-2-1	MFI2 oper.	NU	NU	NU
4-2-2	MFI2 IntL	-	-	-
4-2-3	1 + 2 IntL	-	-	-
4-2-4	MFI2 2OLL	-	-	-
4-2-5	MFI2 CIntL	-	-	-
4-2-6	1 + 2 CIntL	-	-	-
4-3-1	ROUT oper.	OL	OL	OL
4-3-2	ROUT Logic	Norm	Norm	Norm
4-3-3	ROUT LoadX	-	-	-
4-3-4	TempX meas	-	-	-
4-3-5	TempX lim	-	-	-
4-4-1	T1 operat.	B NTC	NU	NU
4-5-1	T2 operat.	B NTC	NU	NU
4-6-1	AOUT oper.	NU	NU	NU
4-6-2	Zero load	-	-	-
4-6-3	Nom. Load	-	-	-
4-7-1	Load Meas.	Motor	Sensor	Sensor
4-7-2	Load rate%	10,00	10	-
4-7-3	R0_F	D	-	-
4-7-4	R0_S	D	-	-
4-7-5	T0	D	-	-
4-7-6	TEMP_SLOW	D	-	-
4-7-7	TEMP_FAST	D	-	-
4-7-8	C2F	D	-	-
4-7-9	C2S	D	-	-

Hoist Control: / Load Measurement:		2 Speeds Motor	2 Speeds Sensor	Inverter Sensor
4 Start-up, continue				
4-7-10	C1F	D	-	-
4-7-11	C1S	D	-	-
4-7-12	ki	D	-	-
4-7-13	Acc-t slow	0.2	0.2	-
4-7-14	Acc-t fast	0.3	0.3	-
4-8	Hoist ctrl	2-SP	2-SP	INV
4-9-1	SR select	NU	NU	NU
4-9-2	Load limit	-	-	-
4-10-1	OT run?	No	No	No
4-10-2	OT limit	-	-	-
4-10-3	Supply sup	No	No	No
4-11-1	Hoist cnt	1	1	1
4-11-2	Run sup.	No	No	No
4-11-3	B OL	No	No	No
4-11-4	B nom load	Single hoist use value from 6.4		
5 Service				
5-1-1	S run time	For Service. If not used, use value 6-9.		
5-1-2	S starts	For Service. If not used, use value 6-7.		
5-1-3	S SWP	For Service. If not used, use value 0.		
5-1-4	S Br SWP%	For Service. If not used, use value 0.		
5-2	Fault log			
5-2-1	FAULT1	I	I	I
5-2-2	ST1	I	I	I
6 Design				
6-1	Hoist name	A	A	A
6-2	Unit No	I	I	I
6-3	Class	I	I	I
6-4	Nom. Load	D	D	D
6-5	Nominal ED	D	D	D
6-6	Sp ratio	6	6	1
6-7	Max ST	D	D	D
6-8	Max E-stop	5000	5000	5000
6-9	Max RT	D	D	D
6-10	D SRT3	D	D	D
6-11	D SRT8	D	D	D
6-12	D SL3	D	D	D
6-13	D SL8	D	D	D
6-14	MaxST MFI1	D	D	D
6-15	MaxRT MFI1	D	D	D
6-16	MaxST MFI2	D	D	D
6-17	MaxRT MFI2	D	D	D
6-18	Max Br	1M000	1M000	D
6-19	MaxControl	640k0	640k0	640k0
6-20	Password	D	D	D

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Appendix 2 - Version History

Software version history

Version	Changes
SW 1.9	• First production SW • Only one hoist operation
SW 1.98	• Two hoists operation • Corrections to AOUT
SW 2.000	• Serial number - H00678 - H01660 - T00187 - T00730 • Multihoisting operation
SW 2.004	• Serial number - H01661- H05697 - T00731- T01945 • Motor torque calculation works better in IT-network • Tare function: ESC button must be pressed for three seconds to tare the load • Improved AOUT resolution. • Fault Brake limit -50%
SW 2.100	• Serial number - H05698 - - T01946 - • Multi hoisting supervision works better • Continous load update in Sensor application • Fault, Srope • Bridge nominal load parameters doesn't influence the load display for single hoists. • More information to the serial port. • Load signal filtering: serial port 60ms, AOUT & ROUT 200ms, Slack rope and units load display 1000ms.

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Hardware version history

Version	Changes
HW C	• First production HW • Serial number - H00677 - T00263
HW D	• Serial number - H00678 – H01287 - T00264 – T00496 • Layout (Diode, ferrite) • AC-inputs layout • Current loop to RJ terminal • CAN-bus speed (25 kB => 50 kB)
HW E	• Serial number - H01288 – H02324 - T00497 – T01087 • Layout (Leds and display's switch) • El.capacitors with improved lifetime • Butterworth filter • AC-input resistors • AC-input FET 600V -> 800V (115VAC) • AC-input diode 600V -> 2000V
HW H	• Serial number - H02325 – H03308 - T01088 – T01310 • AC-input Layout • AC-input diode 2000V -> 4000V • AC-input varistor • AC-input FET 600V -> 800V • Transformer
HW K	• Serial number - H03309 – H07182 - T01311 - T02376 • Few resistors' type • HW K1 (Green sticker) • Since 8.12.03 a diode has been added to the clock rate circuit.
HW L	• Serial number - H07183 - - T02377 - • The clock rate circuit's layout • Few soldering seams have been enlarged.

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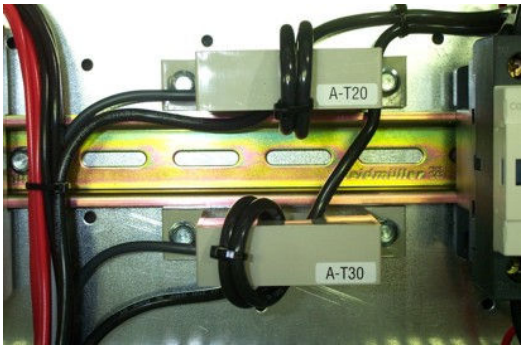
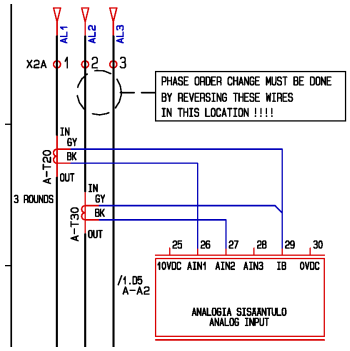
Appendix 3 - Current Transformer's information

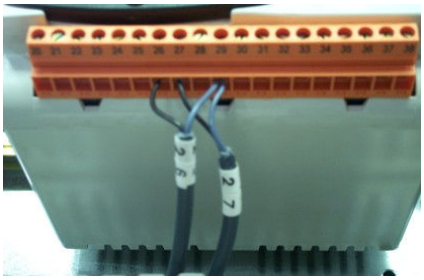
Current transformer connections

Current transformers are connected between the incoming terminal block and hoisting contactor. Phase lines are coming from terminal block and going through the current transformer(s) and then going to the contactor.



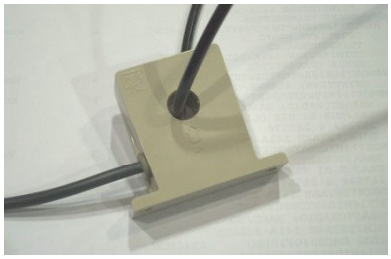


Current transformer A-T20's black wire is connected to the terminal 26 and current transformer A-T30's black wire is connected to the terminal 27. The grey wires of both current transformers are connected to the terminal 29, +5 VDC. If there is only one current transformer it is connected between terminals 27 and 29.



There are two current transformers in motor torque calculation and one current transformer in load sensor based system.

An arrow and text IN is printed on one side of MI20. Put the coming phase line through the current transforms from that side. In both pictures the phase line goes one time through the current transformers. (1 ROUND)



Current transformer MI100 has a sticker on the side that phase line is put trough the current transformers. On the sticker is a arrow and text IN.

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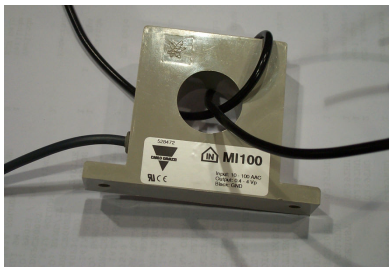
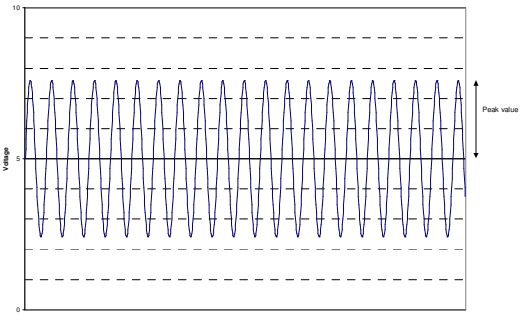
Phase line goes two times through the current transformer. (2 ROUNDS)



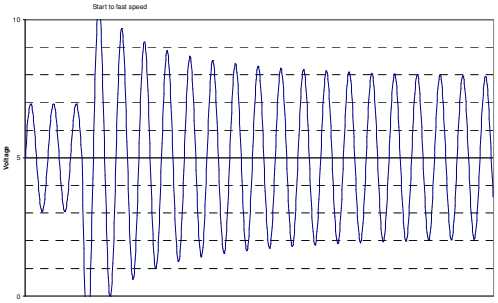
Phase line goes three times through the current transformers. (3 ROUNDS)

The current transformer's grey wire is connected to the terminal 29. The terminal 29 is neutral level for current transformers. The current transformer's neutral level point is +5 VDC so the unit can measure positive and negative values from current.



Maximum peak value is 3.5V and maximum effective value is 2.5 VAC. It is possible that start current gives bigger output value from current transformers than what are maximum values, therefore supervisions are by-passed time of start.

Start time parameters are "4-7-13 Start time to slow speed" and "4-7-14 Start time to fast speed".



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Appendix 3.1 Current transformer table

Current transformer choosing

Motor type	Un/f V/Hz	In/A high	In/A low	Current transformer type	Turn of winding the primary coil		In/V high whit secondary Peek value	In/V low whit secondary Peek value		In/V high whit secondary Effective value	In/V low whit secondary Effective value	Ik Hoist control device Parameters 4-7-12
MF10M	208/60	9,8	5,9	MI20	1		1,96	1,18		1,39	0,83	7,071
	230/50	8,2	4,2	MI20	1		1,64	0,84		1,16	0,59	7,071
	230/60	9,0	4,6	MI20	1		1,80	0,92		1,27	0,65	7,071
	380/60	5,0	2,8	MI20	3		3,00	1,68		2,12	1,19	2,357
	400/50	4,7	2,4	MI20	3		2,82	1,44		1,99	1,02	2,357
	460/60	4,5	2,3	MI20	3		2,70	1,38		1,91	0,98	2,357
	500/50	3,8	1,9	MI20	4		3,04	1,52		2,15	1,07	1,768
	575/60	3,6	1,8	MI20	4		2,88	1,44		2,04	1,02	1,768
	660/50	2,8	1,5	MI20	4		2,24	1,20		1,58	0,85	1,768
MF10Z	208/60	10,0	5,1	MI20	1		1,99	1,02		1,41	0,72	7,071
	230/50	14,3	6,8	MI20	1		2,86	1,36		2,02	0,96	7,071
	230/60	16	7,6	MI20	1		3,20	1,52		2,26	1,07	7,071
	380/60	8,7	4,6	MI20	2		3,48	1,84		2,46	1,30	3,536
	400/50	8,2	4,3	MI20	2		3,28	1,72		2,32	1,22	3,536
	460/60	8,0	3,8	MI20	2		3,20	1,52		2,26	1,07	3,536
	500/50	6,6	3,1	MI20	2		2,64	1,24		1,87	0,88	3,536
	575/60	6,4	3	MI20	2		2,56	1,20		1,81	0,85	3,536
	660/50	5	2,4	MI20	3		3,00	1,44		2,12	1,02	2,357
MF10X	208/60	21,9	10,4	MI100	3		2,63	1,25		1,86	0,88	11,79
	230/50	17,2	9,6	MI100	3		2,06	1,15		1,46	0,81	11,79
	230/60	19,8	9,4	MI100	3		2,38	1,13		1,68	0,80	11,79
	380/60	12	5,7	MI20	1		2,40	1,14		1,70	0,81	7,071
	400/50	9,9	5,5	MI20	1		1,98	1,10		1,40	0,78	7,071
	460/60	9,9	4,7	MI20	1		1,98	0,94		1,40	0,66	7,071
	500/50	7,9	4,4	MI20	2		3,16	1,76		2,23	1,24	3,536
	575/60	7,9	3,8	MI20	2		3,16	1,52		2,23	1,07	3,536
	660/50	6	3,3	MI20	2		2,40	1,32		1,70	0,93	3,536
MF11XA	208/60	36,0	19,0	MI100	2		2,88	1,52		2,04	1,07	17,68
	230/50	27,8	14,8	MI100	2		2,22	1,18		1,57	0,84	17,68
	230/60	32,5	17,2	MI100	2		2,60	1,38		1,84	0,98	17,68
	380/60	21,0	11,0	MI20	1		1,68	0,88		1,19	0,62	7,071
	400/50	16	8,5	MI20	1		3,20	1,70		2,26	1,20	7,071
	460/60	17,0	9,1	MI20	1		3,40	1,82		2,40	1,29	7,071
	500/50	12,8	6,8	MI20	1		2,56	1,36		1,81	0,96	7,071
	575/60	14,0	7,3	MI20	1		2,80	1,46		1,98	1,03	7,071
	660/50	9,7	5,2	MI20	1		1,94	1,04		1,37	0,74	7,071
MF11X	208/60	42,0	21,0	MI100	2		3,36	1,68		2,38	1,18	17,68
	230/50	34,1	16,5	MI100	2		2,73	1,32		1,93	0,93	17,68
	230/60	38,0	17,4	MI100	2		3,04	1,39		2,15	0,98	17,68
	380/60	23,0	10,5	MI100	3		2,76	1,26		1,95	0,89	11,79
	400/50	19,6	9,5	MI100	3		2,35	1,14		1,66	0,81	11,79
	460/60	19,0	8,7	MI100	3		2,28	1,04		1,61	0,74	11,79
	500/50	15,7	7,6	MI20	1		3,14	1,52		2,22	1,07	7,071
	575/60	15,2	7,0	MI20	1		3,04	1,40		2,15	0,99	7,071
	660/50	11,9	5,8	MI20	1		2,38	1,16		1,68	0,82	7,071

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Motor type	Un/f V/Hz	In/A high	In/A low	Current transformer type	Turn of winding the primary coil		In/V high whit secondary Peek value	In/V low whit secondary Peek value		In/V high whit secondary Effective value	In/V low whit secondary Effective value	Ik Hoist control device Parameters 4-7-12
MF13Z	208/60	71,5	27,0	MI100	1		2,86	1,08		2,02	0,76	35,36
	230/50	56,0	27,0	MI100	1		2,24	1,08		1,58	0,76	35,36
	230/60	64,6	22,8	MI100	1		2,58	0,90		1,82	0,64	35,36
	380/60	37,5	18,2	MI100	2		3,00	1,45		2,12	1,03	17,68
	400/50	31,0	15,0	MI100	2		2,48	1,20		1,75	0,85	17,68
	460/60	31,0	15,0	MI100	2		2,48	1,20		1,75	0,85	17,68
	500/50	26,0	11,0	MI100	2		2,08	0,88		1,47	0,62	17,68
	575/60	26,0	10,0	MI100	2		2,08	0,80		1,47	0,57	17,68
	660/50	21,6	19,5	MI100	3		2,59	2,34		1,83	1,66	11,79
MF13X	208/60	80,8	32,3	MI100	1		3,23	1,29		2,29	0,91	35,36
	230/50	66	28	MI100	1		2,64	1,12		1,87	0,79	35,36
	230/60	73,0	29,0	MI100	1		2,92	1,16		2,06	0,82	35,36
	380/60	46,0	19,0	MI100	1		1,84	0,76		1,30	0,53	35,36
	400/50	38	16	MI100	2		3,04	1,28		2,15	0,91	17,68
	460/60	38,0	16,0	MI100	2		3,04	1,28		2,15	0,91	17,68
	500/50	30,4	12,8	MI100	2		2,43	1,02		1,72	0,72	17,68
	575/60	30,0	13,0	MI100	2		2,40	1,04		1,70	0,74	17,68
	660/50	23	9,7	MI100	3		2,76	1,16		1,95	0,82	11,79
MF13XA	208/60	98,0	47,0	MI100	1		3,92	1,88		2,77	1,33	35,36
	230/50	85,0	40,0	MI100	1		3,40	1,60		2,40	1,13	35,36
	230/60	88,0	42,5	MI100	1		3,52	1,70		2,49	1,20	35,36
	380/60	57,0	27,0	MI100	1		2,28	1,08		1,61	0,76	35,36
	400/50	49,0	23,0	MI100	1		1,96	0,92		1,39	0,65	35,36
	460/60	47,0	22,0	MI100	1		1,88	0,88		1,33	0,62	35,36
	500/50	39,0	18,0	MI100	2		3,12	1,44		2,21	1,02	17,68
	575/60	38,0	18,0	MI100	2		3,04	1,44		2,15	1,02	17,68
	660/50	30,0	14,0	MI100	2		2,40	1,12		1,70	0,79	17,68
Two	208/60	143,0	54,0	MI500	1		1,14	0,43		0,81	0,30	176,78
MF13Z	230/50	112,0	54,0	MI500	1		0,90	0,43		0,63	0,31	176,78
	230/60	129,2	45,0	MI500	1		1,03	0,36		0,73	0,25	176,78
	380/60	75,1	36,3	MI100	1		3,00	1,45		2,12	1,02	35,36
	400/50	57,0	30,0	MI100	1		2,28	1,20		1,61	0,85	35,36
	460/60	62,0	30,0	MI100	1		2,48	1,20		1,75	0,85	35,36
	500/50	52,0	22,0	MI100	1		2,08	0,88		1,47	0,62	35,36
	575/60	52,0	20,0	MI100	1		2,08	0,80		1,47	0,57	35,36
	660/50	43,2	39,0	MI100	1		1,73	1,56		1,22	1,10	35,36
Two	208/60	161,6	64,6	MI500	1		1,29	0,52		0,91	0,37	176,78
MF13X	230/50	132,0	56,0	MI500	1		1,06	0,45		0,75	0,32	176,78
	230/60	146,0	58,0	MI500	1		1,69	0,46		0,83	0,33	176,78
	380/60	92,0	38,0	MI100	1		3,68	1,52		2,60	1,07	35,36
	400/50	76,0	32,0	MI100	1		3,04	1,28		2,15	0,91	35,36
	460/60	76,0	32,0	MI100	1		3,04	1,28		2,15	0,91	35,36
	500/50	60,8	25,6	MI100	1		2,43	1,02		1,72	0,72	35,36
	575/60	60,0	26,0	MI100	1		2,40	1,04		1,70	0,74	35,36
	660/50	46,0	19,4	MI100	1		1,84	0,78		1,30	0,55	35,36

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Appendix 4 - Motor temperature NTC charts

A NTC
Bccomponents NTC 23226338.303
R_{25} = 30 k

T / C	R_T / R_{25}	R / kΩ
-40	33.060000	991.8000
-35	23.900000	717.0000
-30	17.470000	524.1000
-25	12.900000	387.0000
-20	9.621000	288.6300
-15	7.242000	217.2600
-10	5.501000	165.0300
-5	4.214000	126.4200
0	3.255000	97.6500
5	2.534000	76.0200
10	1.987000	59.6100
15	1.570000	47.1000
20	1.249000	37.4700
25	1.000000	30.0000
30	0.805900	24.1770
35	0.653400	19.6020
40	0.532900	15.9870
45	0.437100	13.1130
50	0.360400	10.8120
55	0.298800	8.9640
60	0.248900	7.4670
65	0.208400	6.2520
70	0.175300	5.2590
75	0.148100	4.4430
80	0.125600	3.7680
85	0.107000	3.2100
90	0.091560	2.7468
95	0.078620	2.3586
100	0.067770	2.0331
105	0.058630	1.7589
110	0.050890	1.5267
115	0.044330	1.3299
120	0.038730	1.1619
125	0.033950	1.0185
130	0.029850	0.8955
135	0.026330	0.7899
140	0.023280	0.6984
145	0.020650	0.6195
150	0.018360	0.5508
155	0.016360	0.4908
160	0.014550	0.4365
165	0.013030	0.3909
170	0.011690	0.3507
175	0.010520	0.3156
180	0.009480	0.2844
185	0.008570	0.2571
190	0.007760	0.2328
195	0.007040	0.2112
200	0.006400	0.1920

B NTC
Siemens NTC B57227 K 227
R_{25} = 32.762 k

T / C	R_T / R_{25}	R / kΩ
-40	41.938000	1373.972756
-35	29.947000	981.123614
-30	21.567000	706.578054
-25	15.641000	512.430442
-20	11.466000	375.649092
-15	8.451000	276.871662
-10	6.292700	206.161437
-5	4.707700	154.233667
0	3.556300	116.511501
5	2.711900	88.8472668
10	2.086000	68.341532
15	1.620400	53.087545
20	1.268300	41.552045
25	1.000000	32.762000
30	0.794200	26.019580
35	0.632680	20.727862
40	0.507400	16.623439
45	0.410260	13.440938
50	0.333630	10.930386
55	0.272430	8.925352
60	0.223700	7.328859
65	0.184590	6.047538
70	0.153050	5.014224
75	0.127550	4.178793
80	0.106770	3.497999
85	0.089928	2.946221
90	0.076068	2.492140
95	0.064524	2.113935
100	0.054941	1.799977
105	0.047003	1.539912
110	0.040358	1.322209
115	0.034743	1.138250
120	0.030007	0.983089
125	0.026006	0.852009
130	0.022609	0.740716
135	0.019720	0.646067
140	0.017251	0.565177
145	0.015139	0.495984
150	0.013321	0.436423
155	0.011754	0.385085

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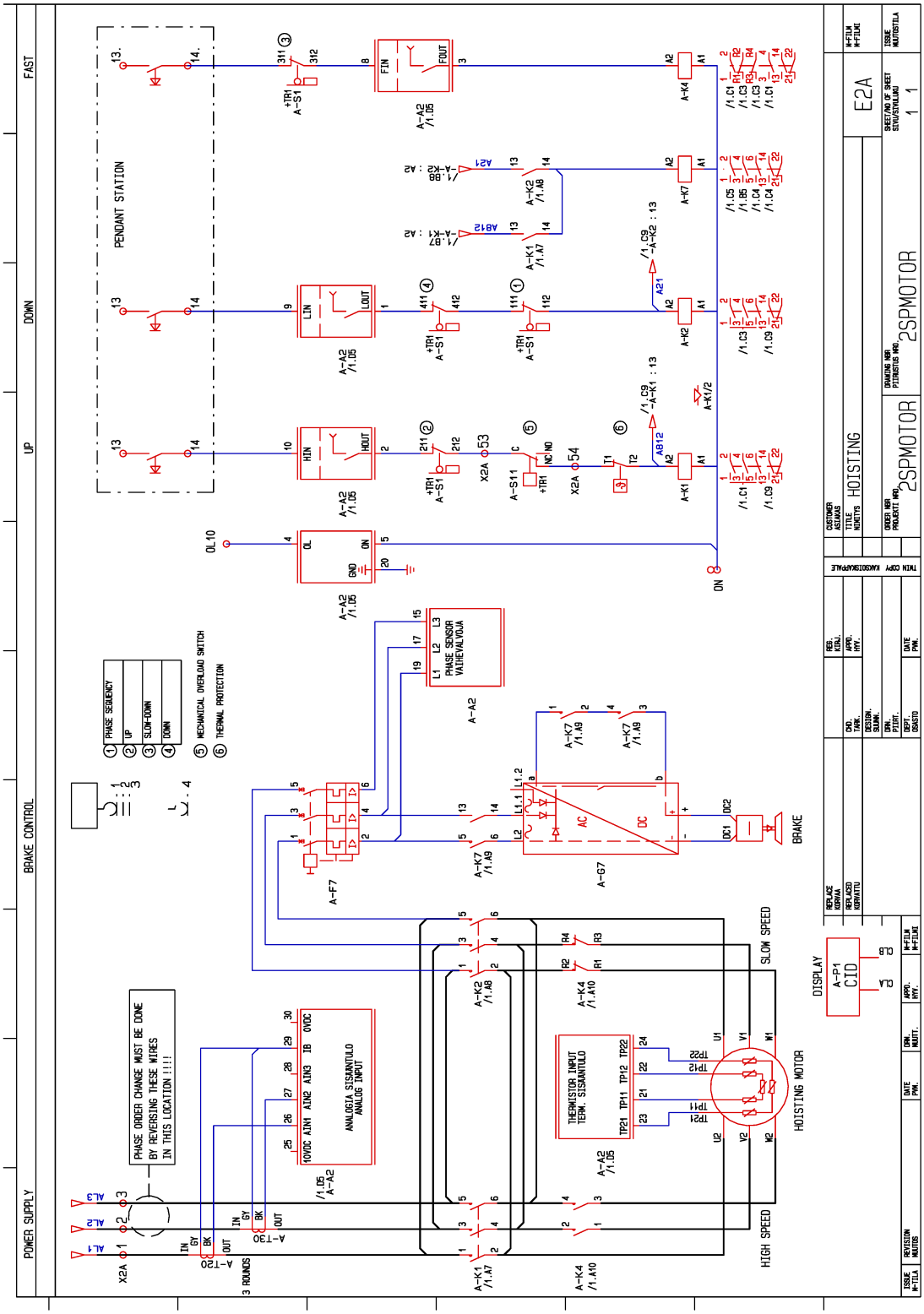
Appendix 5 - Example connections



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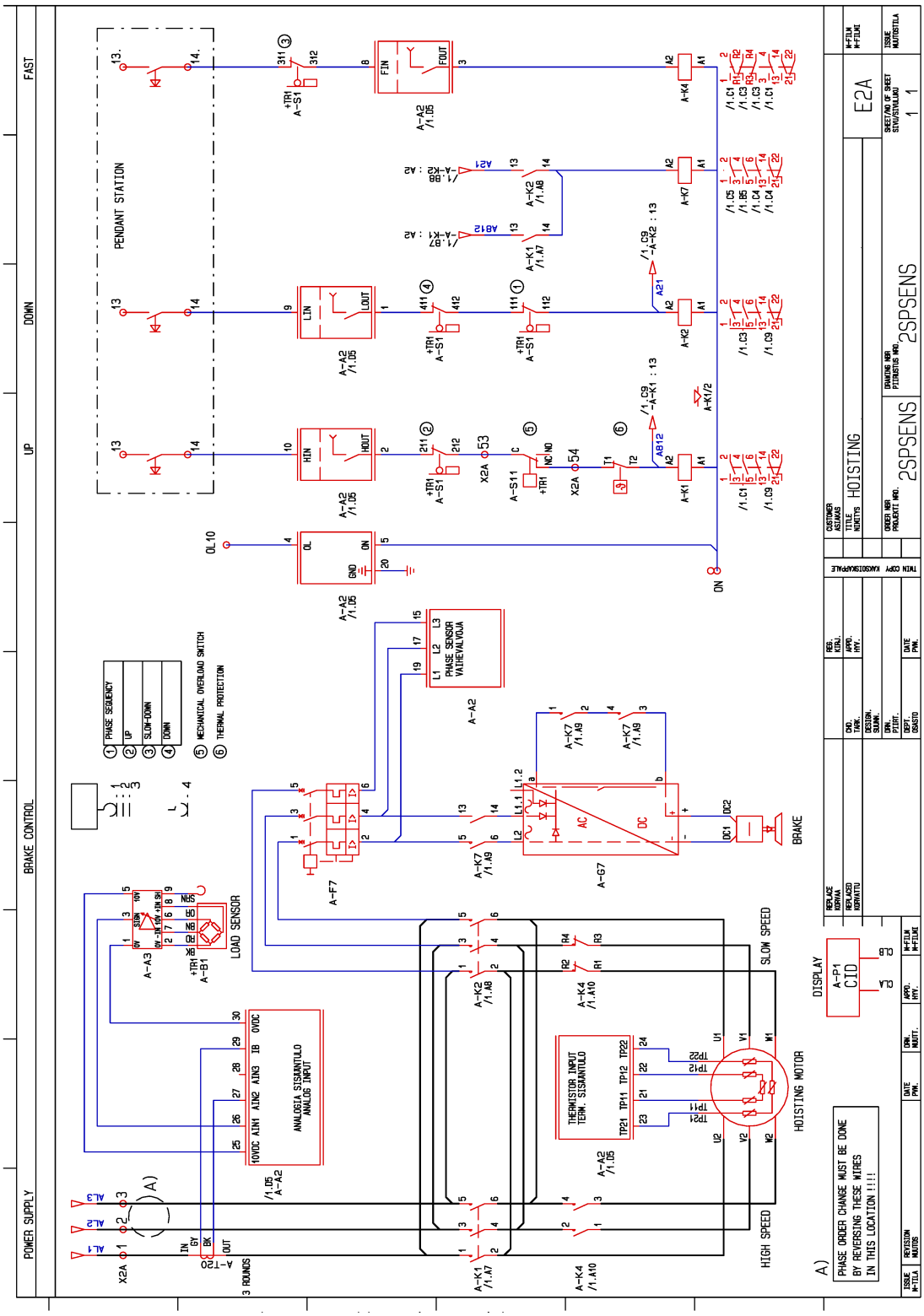

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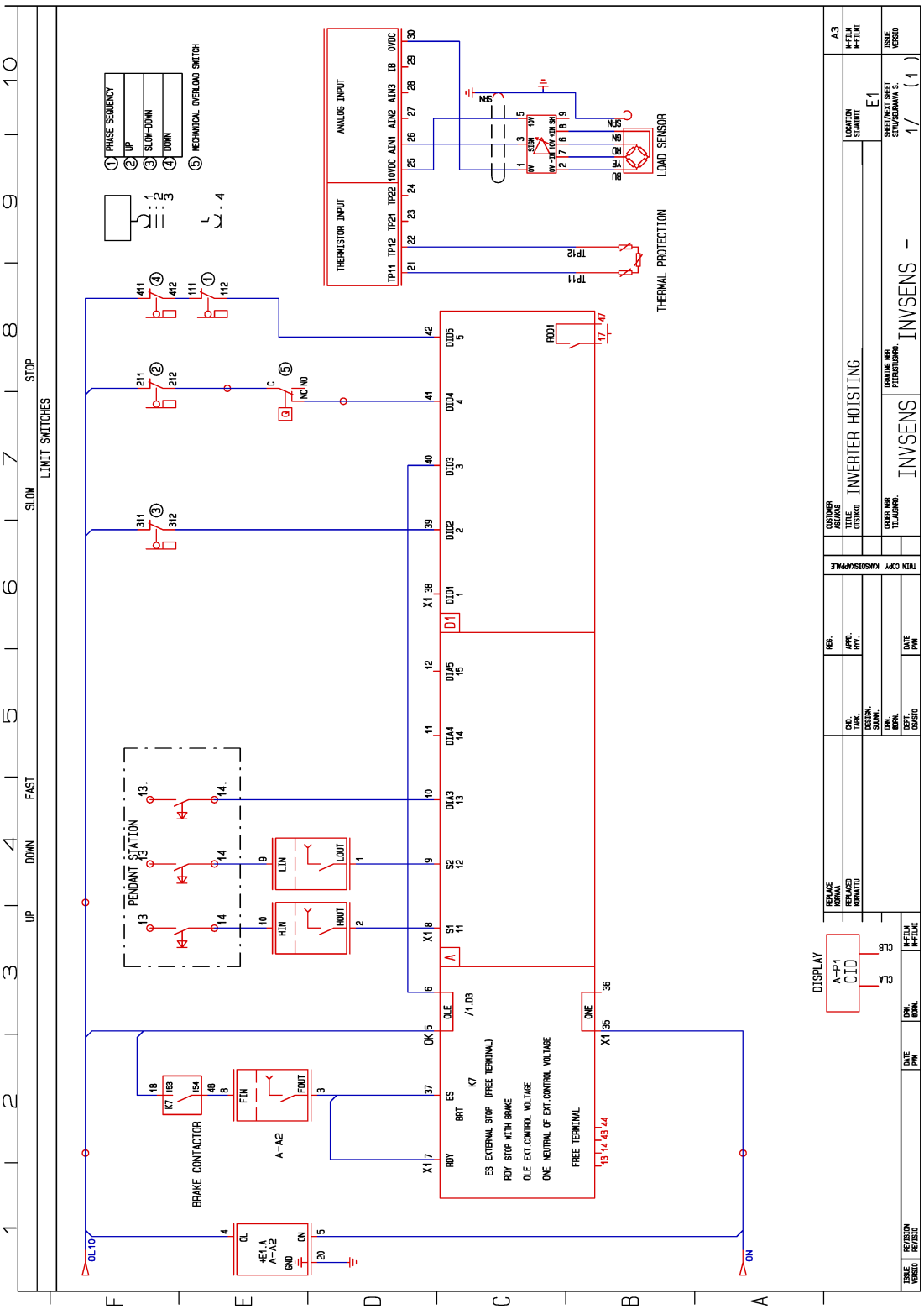

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Appendix 6 - External power supply for ESD 143

General

The current of 10VDC of the Control Pro is limited to 50mA. When KAE400 (ESD142), strain-gauge sensor and EDS143 or KAE400 (ESD142) and two strain-gauge sensor is used simultaneously the needed current is much over 50mA. Furthermore, the current of relay card ESD143 alternates depending on the state of the relays. That affects to the output voltage of the Control Pro and also to the accuracy of the load measuring. In worst case the relay card starts to vibrate because of voltage alternation.
That is why external power supply is used whenever ESD143 or two strain-gauge sensors and KAE400 (ESD142) is used. After tests it has been decided that ETA Power Source WRM22FWX-U (from Perel Oy) is started to use. Test results can be seen below.

Technical data

Type	WRM22FWX-U
Input Voltage	AC115-230V
Input Current	0.45A
Input Range	AC85-264V(DC110-350V)
Input Frequency	50/60Hz
Output Voltage [V]	2*12VDC
Output Current [A]	0,8A; 0,5A
Operating Temperature	-5 to +40ºC(unit without coer:-5 to +50ºC)
Operating Humidity	30 to 85%RH(non-condensing)

Connection

There are two separate 12 VDC outputs (V1-G1, V2-G2) at the power supply. What we need is 12 VDC for KAE400 (ESD142) and strain gauge sensor and 24 VDC for ESD143. Therefore one 12 VDC output (V1) is connected to the ground of the other one (G2). This way voltage between V2 and G1 will rise to up 24 VDC.
Instead of 18 VAC, 24 VDC is connected to the ESD143. So, external AC transformer is not needed anymore. Zeros of the ESD143 (X1:1, X1:9) is connected together. Voltage output V1 (12 VDC) replaces the 10 VDC output of the Control Pro (:25). Zero volt (:G1) of the power supply and Control Pro (:30) is connected together.

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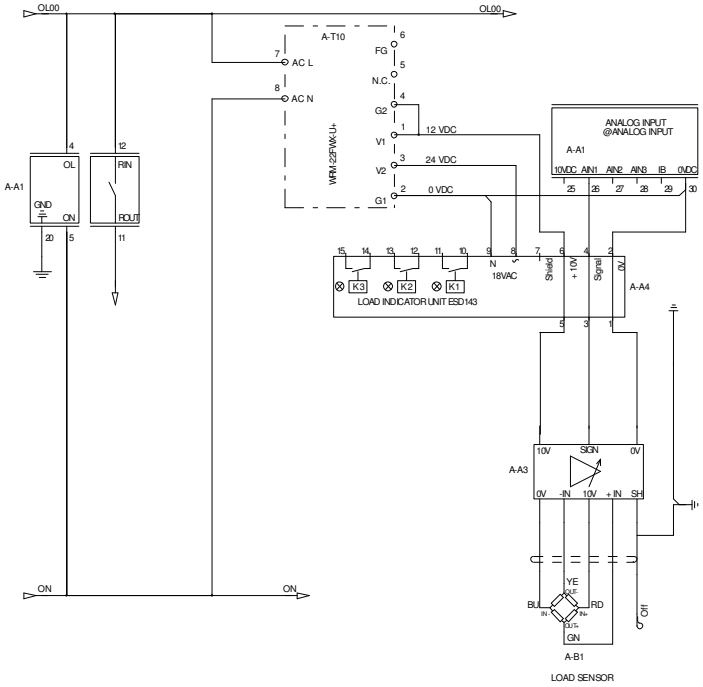
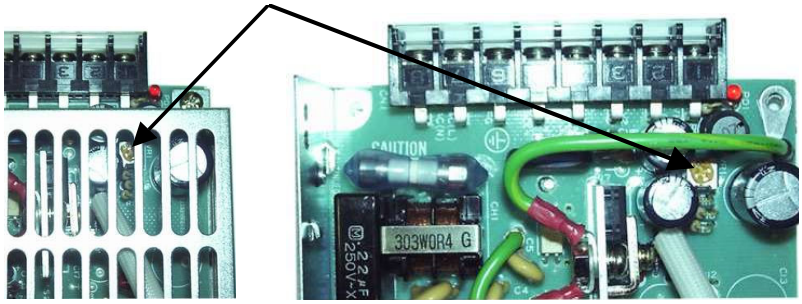
Example drawing



Settings of the external power supply

Voltage output V1 can be adjusted with a trimmer. In our applications voltage must be set to 11,00-11,50 VDC.

V1 voltage adjust trimmer: set to 11.00-11,50 VDC



Power supply with cover plate *Power supply without cover plate*

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Appendix 7 - Replacing the condition monitoring unit

☞ Read through all steps of these instructions and make yourself familiar with the procedure before continuing!

Write down the following information:

Hoist's order Number: _____

Hoist's serial number: _____

Old unit serial number: _____

New unit serial number: _____

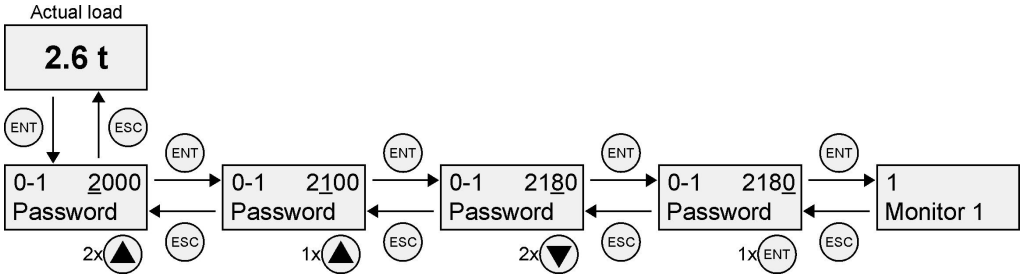
Fill in the requested fields of this document.

Follow the next steps to replace the Control Monitoring unit:

On the display are four pushbuttons for navigating and programming.

ESC	1. Zeroing of tare load. Press ESC button for three seconds. 2. Moving from submenu to main menu and reject parameter changes
▼	1. Toggle between actual load (orange LED off) and tare load (orange LED on) 2. Scrolling down
▲	1. Toggle between actual load (orange LED off) and tare load (orange LED on) 2. Scrolling up
ENT	1. Entering the password level 2. Selecting a menu and accept parameter changes

- Enter password 2180



- Read the parameter 4-7-1 value
  - Push 3 times Up button => Menu 4
  - Push Ent button => Menu 4-1
  - Push 6 times Up button => Menu 4-7
  - Push Ent button => Parameter 4-7-1
    - Check whether parameter shows Motor or Sens.

- Write down the following parameters:
  - Push ESC-button 2 times => Menu 4
  - Push Down-button ones => Menu 3
  - Push ENT-button => Menu 3-1
  - Select menu 3-2 or 3-4 whit Up-button and push ENT-button
  - Read parameters' values. Select parameter by Up- or Down-button

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4-7-1 Load meas = Motor		
3-2-1	Load 1	
3-2-2	Mhs 1	
3-2-3	Mhf 1	
3-2-4	Mls 1	
3-2-5	Mlf 1	
3-2-6	Load 2	
3-2-7	Mhs 2	
3-2-8	Mhf 2	
3-2-9	Mls 2	
3-2-10	Mlf 2	

4-7-1 Load meas = Sens.		
3-4-1	Load 1	
3-4-2	Input 1	
3-4-3	Load 2	
3-4-4	Input 2	

- Push ESC-button 2 timen => Menu 3
- Push 4 times Up-button => Menu 7
- Push ENT-button => Menu 7-1
- Read parameters' values. Select parameter by Up- or Down-button

7-1	Cycles	
7-2	MFI1 RT	
7-3	MFI1 ST	
7-4	MFI2 RT	
7-5	MFI1 ST	
7-6	RT slow	
7-7	RT fast	
7-8	No. OT	
7-9	No. OL	
7-10	E-Stops	
7-11	ST up	
7-12	ST down	

7-13	ST fast	
7-14	Max ED	
7-15	Over ED	
7-16	SRT 3	
7-17	SRT 8	
7-18	SL 1	
7-19	SL 3	
7-20	SL 8	
7-21*	Power on	
7-22*	Temp index	
7-23	Max Load	
7-24	Br Count	

* Setted to 0 in the new unit

- Switch OFF the power supply, remove the orange plug termination X1 and X2 and remove the unit.
- Confirm that the control voltage of the replacement unit (either 48V or 115V) matches the control voltages of the old unit. Insert the new unit.
- Insert the plug termination X1 and X2.
- Insert the display from the old unit into the new unit if the new unit is delivered without display (in case the hoist is equipped with a display in the pendant station, this is not needed).
- Switch ON the power supply.
- Set parameters 3-4-1…3-4-4 and 7-1…7-24 equal to the values written in the above table.
  - Give the password 2180
  - Push Up-button 2 times => Menu 3
  - Push ENT-button => Menu 3-1
  - Select menu 3-2 or 3-4 whit Up-button and push ENT-button
  - Set the down written values into the new unit.

☞ When a parameter has to be adjusted, first select the desired parameter. Pushing the ENT button opens the parameter and the value can be adjusted. The free adjustable parameters will ask to adjust the digits one at the time.

- Go into menu 7 and set parameters 7-1 … 7-24

☞ Set next parameters "7-21 Power on" and "7-22 Temp Index" to 0 on the new unit.

- Make sure there is no load in the hook and check the actual load in slow speed and in fast speed with parameter 2-1-1. The display should show 0.0t, ±5% for nominal load.
  - Push ESC- button
  - Push Up-button twice

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- Hang the test load in the hook and check the actual load in both slow speed and in fast speed with parameter 2-1-1. The display should show the value of the test load, ±5% of nominal load.
  - If the load values are within the given range, the work is finished. Return the old unit to the manufacturer.
  - If the displayed load values differ too much (more than 10%) from the actual (test) load, carry out the calibration procedure as described in Service Manual.
- After the calibration procedure, check the display values again. If the load values are within the given range, the work is finished. Return the old unit to the manufacturer.
- If the new unit shows any fault code, carry out the troubleshooting as described in Service Manual.
- Return the old unit to the manufacturer.